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FACILITIES AND CAPABILITIES OF THE UNITED STATES AIR FORCE SCHO--ETC(U)
JUL 79 S R WINSLOW, E W WILLIAMS, M E GREEN

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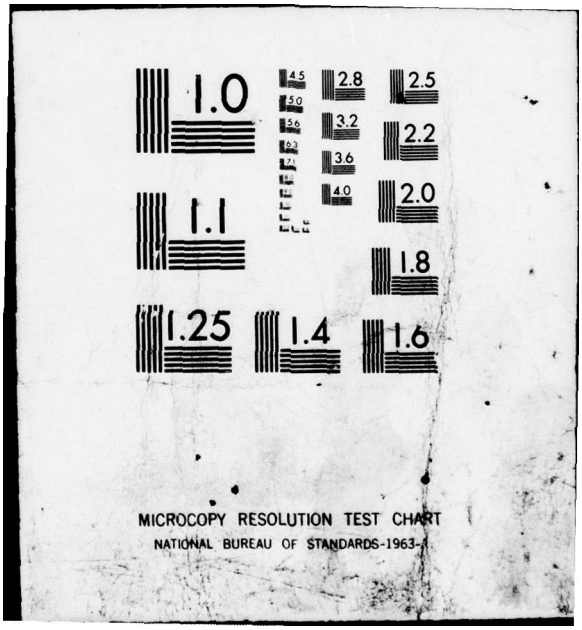
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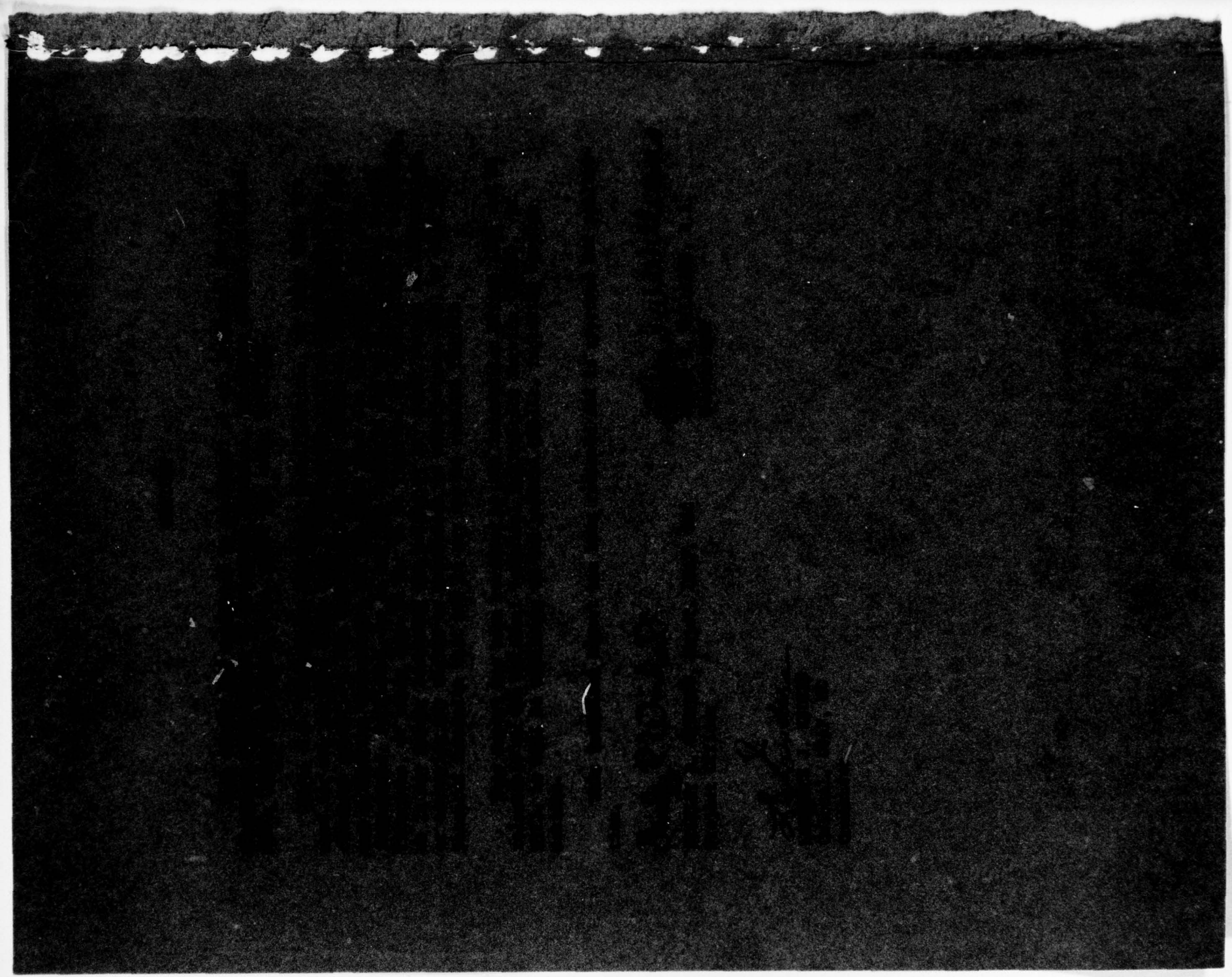

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report outlines the four basic missions of the United States Air Force School of Aerospace Medicine: Medical Research and Development, Medical Evaluation and Consultation, Medical Education, and Aeromedical Support to USAF missions. The facilities and capabilities of each of the nine operational Divisions are presented. The facilities summary outlines equipment specifications and the application of these resources to accomplish the overall mission requirements.

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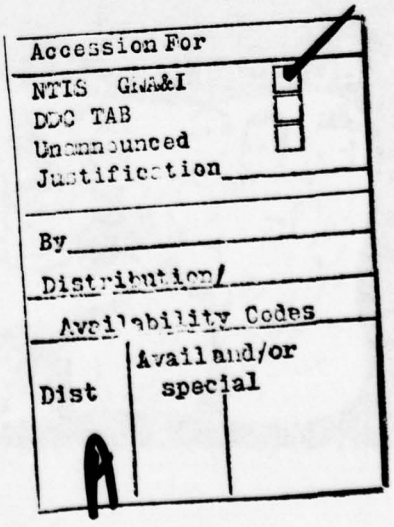
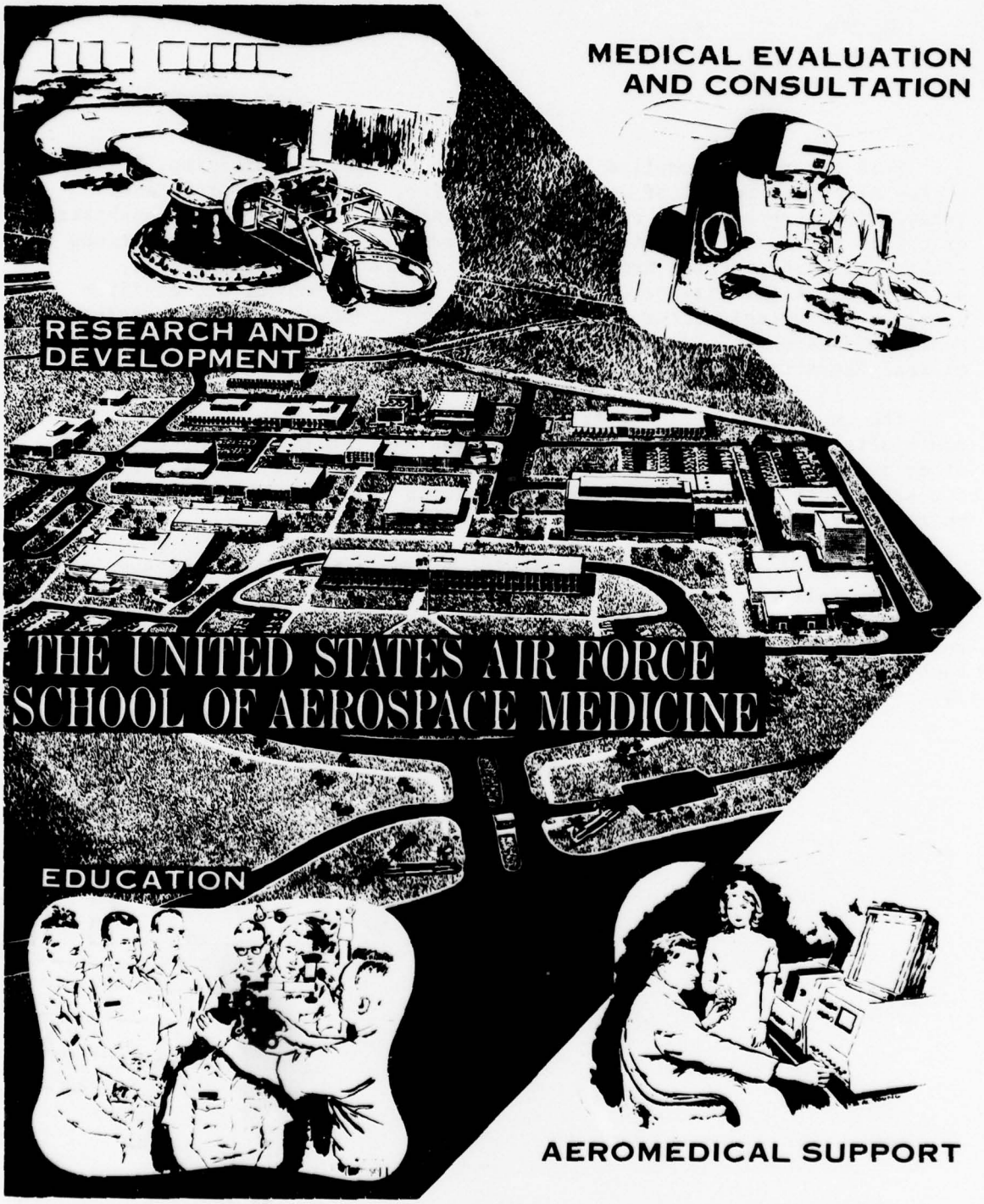
PREFACE

This report was compiled by the Technical Services Division, United States Air Force School of Aerospace Medicine, Brooks Air Force Base, Texas. The purpose is to define and outline the facilities and capabilities of one of the most diversified medically oriented military organizations within the United States Armed Forces. The School, founded in 1918, supports all major Air Force Commands and other Government and civilian agencies and organizations falling within the scope of our four missions: Medical Research and Development, Medical Evaluation and Consultation, Medical Education, and Aeromedical Support to USAF Missions.

The contents of this report are oriented to benefit the medical administrator, educator, physician, dentist, veterinarian, nurse, and other medical personnel, as well as scientists and engineers primarily concerned with specific technical information relating to our major operating facilities.

Each section introduces the mission and capabilities of the specific Division, followed by general information relating to major facilities and equipment items within the Division. When applicable, this is succeeded by technical information relative to equipment specifications, such as model numbers, dimensions, electrical and mechanical characteristics, and operational capabilities.




MEDICAL EVALUATION
AND CONSULTATION
RESEARCH AND
DEVELOPMENT
THE UNITED STATES AIR FORCE
SCHOOL OF AEROSPACE MEDICINE
EDUCATION
AEROMEDICAL SUPPORT

CONTENTS

CONTENTS (Continued)

THE USAF SCHOOL OF AEROSPACE MEDICINE

For more than half a century, the medically oriented problems of the Air Force flyer and his supporting military ground personnel have been the concern of a remarkable military establishment--the United States Air Force School of Aerospace Medicine (USAFSAM), Brooks Air Force Base, Texas, whose facilities and services are among the finest in the world.

The history of the School dates back to 1918, when it was founded at Hazelhurst Field, N.Y., as the Air Service Medical Research Laboratory, a component of the Signal Corps of the U.S. Army. A short time later, the name was changed to the School of Aviation Medicine. In 1926, it moved to Brooks Field in San Antonio; in 1931, to Randolph Field; and then back to Brooks Air Force Base in 1959. The facilities of the School of Aerospace Medicine were formally dedicated by President John F. Kennedy on 21 November 1963. Today it stands as a fitting tribute to pioneers in aviation medicine.

The Air Force is continually and actively engaged in an effort to improve both its weapons and support systems; however, as these new systems evolve, the biologic limitations of those who command and operate all types of these systems remain essentially the same. Our staff of military and civilian personnel represent not only every medical science and specialty concerned with aviation medicine but also most of the fundamental sciences. They actively investigate and solve complex problems associated with man's ability to perform efficiently in hazardous environments. Their efforts encompass four basic missions:

1. Medical Research and Development is the predominant mission. Here, the major goal is to overcome the hazards created by Air Force systems both in flight and on the ground. Conceptual and existing systems dictate a need for biotechnology to produce and maintain habitable aircrew environments and eliminate toxic hazards. New developments and modifications to assure the safety and efficiency of aircrew and support personnel exposed to dangerous mechanical forces singly or in combination with other environmental extremes are needed. Man's performance capabilities are evaluated because of their increased importance in the design, operation, and maintenance of Air Force systems. For example, the use of electromagnetic and particulate radiation in weapons, communications, surveillance, and reconnaissance systems necessitates the development of standards, procedures, and equipment to assist Air Force personnel during hazardous operations. Aeromedical research and development, therefore, includes every effort necessary to define biomedical requirements for personnel in various aerospace environments, to extend and enhance personnel performance in USAF systems, and to develop improved technology in support of the overall Air Force mission.

2. Medical Evaluation and Consultation is provided for Air Force pilots and crewmembers whose fitness for flying is in question. All are given the most complete and exhaustive examination possible anywhere. Flying personnel with difficult, obscure, or borderline medical problems that affect their flying status constitute the majority of patients. Skilled medical personnel utilizing the most modern physiologic monitoring equipment available provide medical evaluation of specific categories of flying personnel and conduct studies in unique medical problem areas. This mission also includes operation and maintenance of the USAF Hearing Conservation Data Repository, the USAF Electrocardiographic Repository, and corollary repositories as indicated by medical requirements. Hyperbaric chambers are used to establish clinical indications for hyperbaric oxygenation and determine clinical and cost effectiveness of hyperbaric oxygenation for USAF hospitals.

3. Medical Education is offered in all subjects relating to Aerospace Medicine for medical and dental officers, nurses, engineers, veterinarians, aeromedical technicians, and physiologic training officers and supervisors representing the Air Force, the Army, and allied students from most of the free nations. There are courses and conferences in clinical medicine, aerospace medicine, and related fields. The Education mission also involves technical support of USAF mission objectives to include preparation of course and job training standards for individual training. Approximately 3,000 students graduate annually.

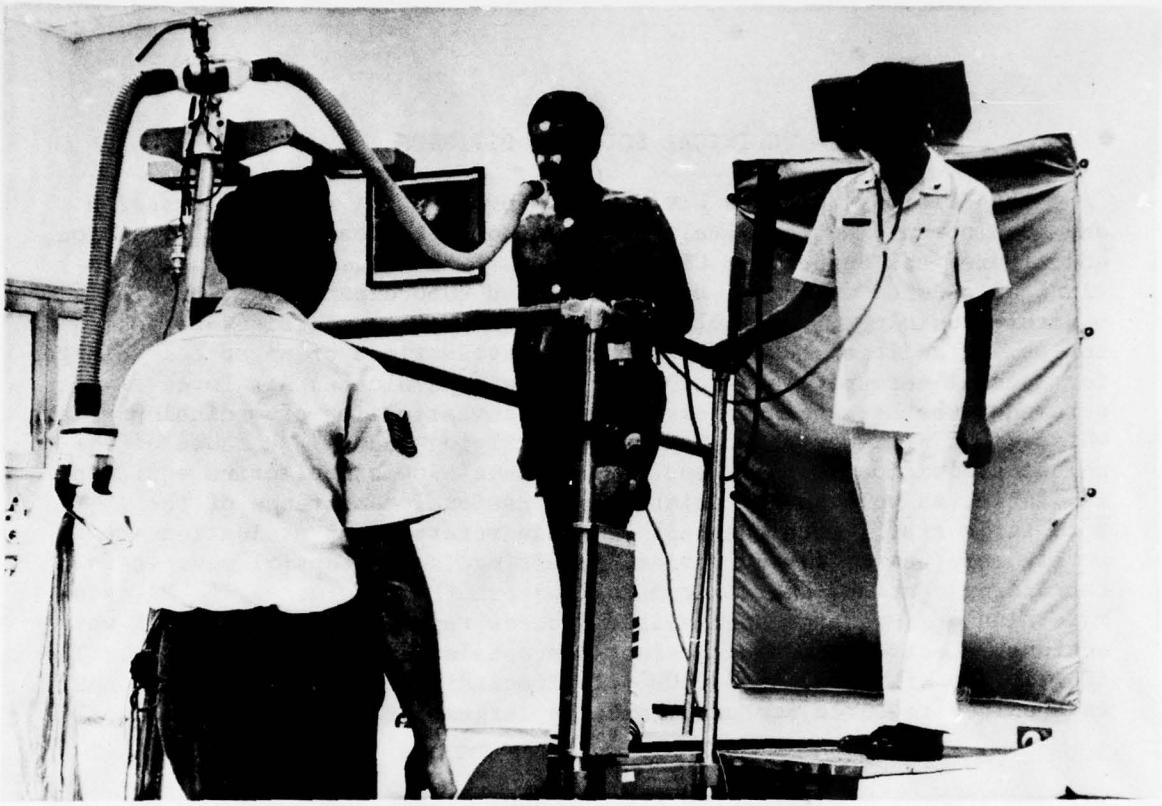
4. Aeromedical Support to USAF Missions fulfills the following goals: to provide a variety of specialized services which include conducting field studies and epidemiologic surveys in areas of operation where outbreaks of disease occur or may be imminent; to provide and maintain a USAF reference and consultant center for medical entomology; to provide and maintain a consultant and reference laboratory capability in the disciplines of bacteriology, parasitology, serology, virology, and chemistry; and to function as an epidemiology surveillance center for the USAF Medical Service to collect, collate, and summarize epidemiologic information. The mission includes active involvement and technological research in the Drug Abuse Counteroffensive Program of the Department of Defense.

CLINICAL SCIENCES DIVISION

The Clinical Sciences Division is involved in: Medical Research and Development, Medical Evaluation and Consultation, Medical Education, and Aeromedical Support to USAF Missions. The Division consists of a clinical science facility; several related subordinate functions including optical, audiology, vestibular, psychobiology, and radioisotope laboratories. In addition to offering medical evaluations of personnel selected for special aerospace projects, the Division evaluates Air Force flying personnel who have been referred for an investigation of medical problems which might preclude their remaining on flying status. Because of the unique evaluation technics and dynamic physiologic monitoring equipment available, as well as the existing professional competence of the scientific staff, more than 65% of those referred for evaluation are safely returned to flying duties, resulting in substantial savings in retraining cost and increased morale within the Air Force. The Division maintains and operates specialized records repositories of medical waiver actions, electrocardiograms, electroencephalograms, and audiograms. The ECG library of more than 800,000 electrocardiograms on flying personnel is a unique resource for study and the largest of its type in the world.

EXERCISE ELECTROCARDIOGRAPHY

Since the establishment of the Aeromedical Consultation Service in 1955, a wealth of electrocardiographic data has been recorded at USAFSAM. In an effort to detect latent coronary disease in flying personnel at the earliest possible time, serial electrocardiographic tracings are carefully reviewed by the USAF Central ECG Library. Aircrew members with abnormal or borderline findings presenting as serial changes or arrhythmias are referred to USAFSAM for further evaluation. Following preliminary tracings, the patient is asked to perform exercise to his maximum tolerance on a standard treadmill, under close medical supervision. The treadmill belt moves at 3.3 miles per hour, with an increase in grade of 5% every 3 minutes. ECG tracings are simultaneously collected from multiple bipolar and orthogonal leads, displayed on an oscilloscope for the attending physician, and recorded on magnetic tape for computer analysis. Pulse rate, blood pressure response, and maximum oxygen utilization during exercise are also recorded. This procedure has proved to be of great value in the early detection of heart disease and significance of arrhythmias and is conducted with precision and safety by members of the SAM medical staff.



Treadmill - Exercise Electrocardiography

PORTABLE ELECTROCARDIOGRAPHIC MONITORING

General Information

This system is used to obtain a single-lead tape-recorded electrocardiogram while a patient pursues his routine daily activities. The data are used to correlate suspected cardiac rhythm disturbances. Periods of poor blood flow to heart muscle can be correlated with repolarization changes throughout the daily recording periods.

The recorder allows superimposition of the electrical pattern drawn by successive heartbeats to be displayed on an oscilloscope. Heart rate is computed by the generation of a sawtooth voltage, the heights of which are proportional to the interval between successive R waves, the part of the cardiac cycle of the greatest voltage. These voltages are displayed on a separate oscilloscope, which has been calibrated for heart rate, and are also used to generate an audible signal which corresponds to the

heart rate. Any change in configuration of the major cardiac waveform (QRS complex) that is detected may be reproduced in equivalent real time on standard electrocardiographic paper.

Portable Electrocardiography

Technical Information

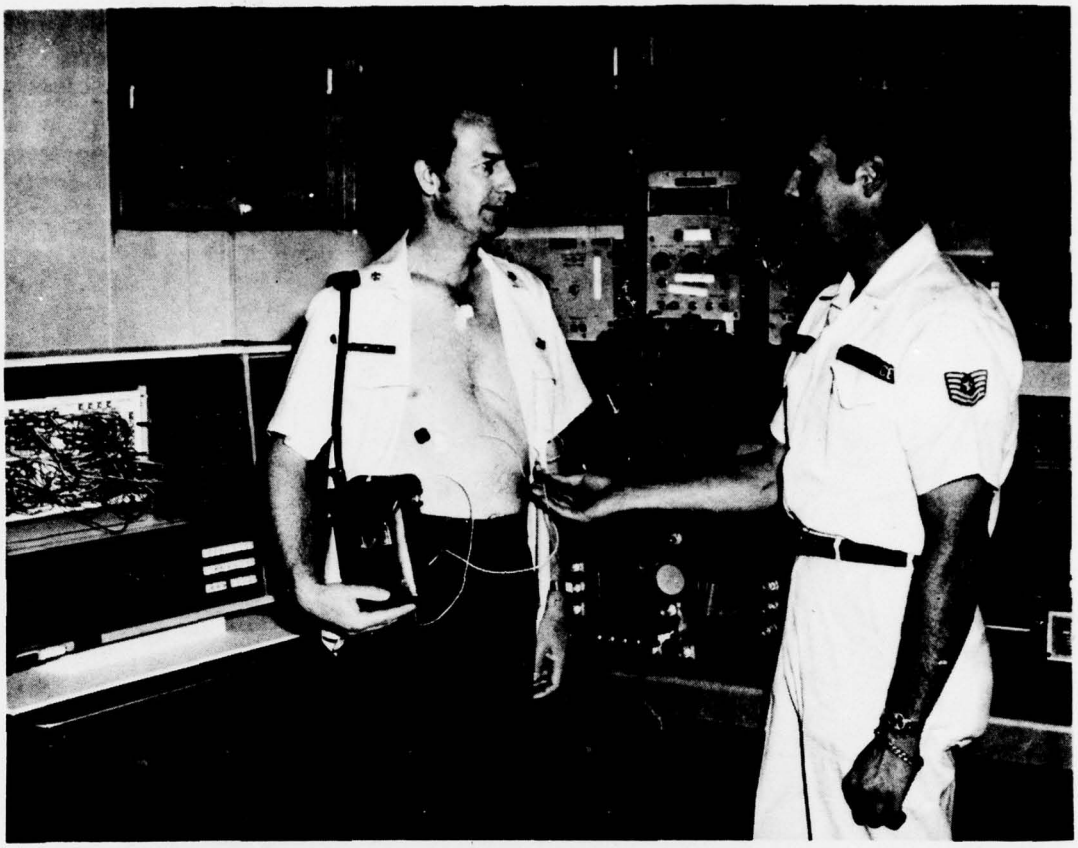
Model 350 Electrocardiocorder

Provides a 6- to 8-hour continuous one-lead recorded electrocardiogram

Weight: 1.9 kg

Recording speed: 7½ in. per min

Recording duration time: 8 to 10 hrs



Portable Electrocardiographic Recording

NONINVASIVE CARDIOGRAPHY

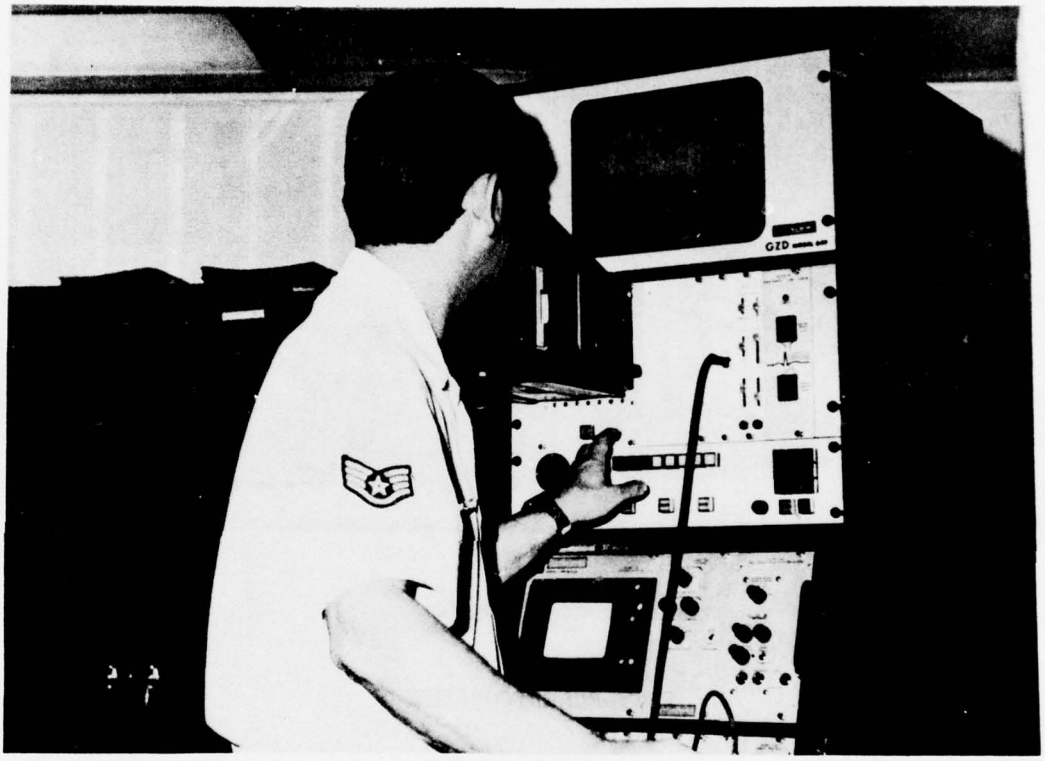
Among the examinations performed at USAFSAM to determine cardiac function are those tests referred to as noninvasive diagnostic examinations.

ECHOCARDIOGRAPHY

Echocardiography is routinely performed on patients undergoing evaluation in the Internal Medicine Branch. This technique utilizes ultra high frequency sound to graphically record the movements of intercardiac structures without risk or discomfort to the patient. Among the many conditions which can be diagnosed with accuracy and certainty by echocardiography are rheumatic valvular disease, mitral valve prolapse, asymmetric septal hypertrophy, most forms of congenital heart disease, and pericardial diffusion. In an increasing number of incidences, a properly performed echocardiographic examination is of such diagnostic

quality as to render cardiac catheterization unnecessary. A complete noninvasive cardiac examination can usually be performed and interpreted in less than 1 hour.

Technical Instrumentation: SKI (Smith, Kline Instrument) integrated with an E for M VR6 Simultrace Recorder



Echocardiogram

PHONOCARDIOGRAPHY

Phonocardiography is utilized to record the presence and timing of abnormal heart sounds. Heart sounds recorded simultaneously with the carotid pulse tracing and the electrocardiogram are used to determine the systolic time intervals which are very useful noninvasive measures of dysfunction of the left ventricle as a whole. The apexcardiogram, which graphically records the mechanical movements of the cardiac apex relative to the chest wall, is useful for screening for various forms of myocardial disease.

Technical Instrumentation: E for M VR6 Simultrace Recorder

Phonocardiogram

VECTORCARDIOGRAPHY

General Information

A spatial vectorcardiogram (VCG) is the tridimensional display of all the resultant instantaneous electromotive forces generated during all phases of the heart's activity. Used as an adjunct to the scalar electrocardiogram, the VCG is able to confirm areas of cardiac malfunction or conduction delay. It also provides precise information on the timing of electrical events within the heart.

A planar vectorcardiogram is the projection of these forces on a particular plane such as the horizontal, the frontal, or the left sagittal planes of a rectangular coordinate system. These planar projections of the spatial vectorcardiogram constitute the conventional vectorcardiographic recordings used in clinical cardiology.

The advantage of vectorcardiography over scalar electrocardiography is that the planar projections give a more comprehensive presentation of

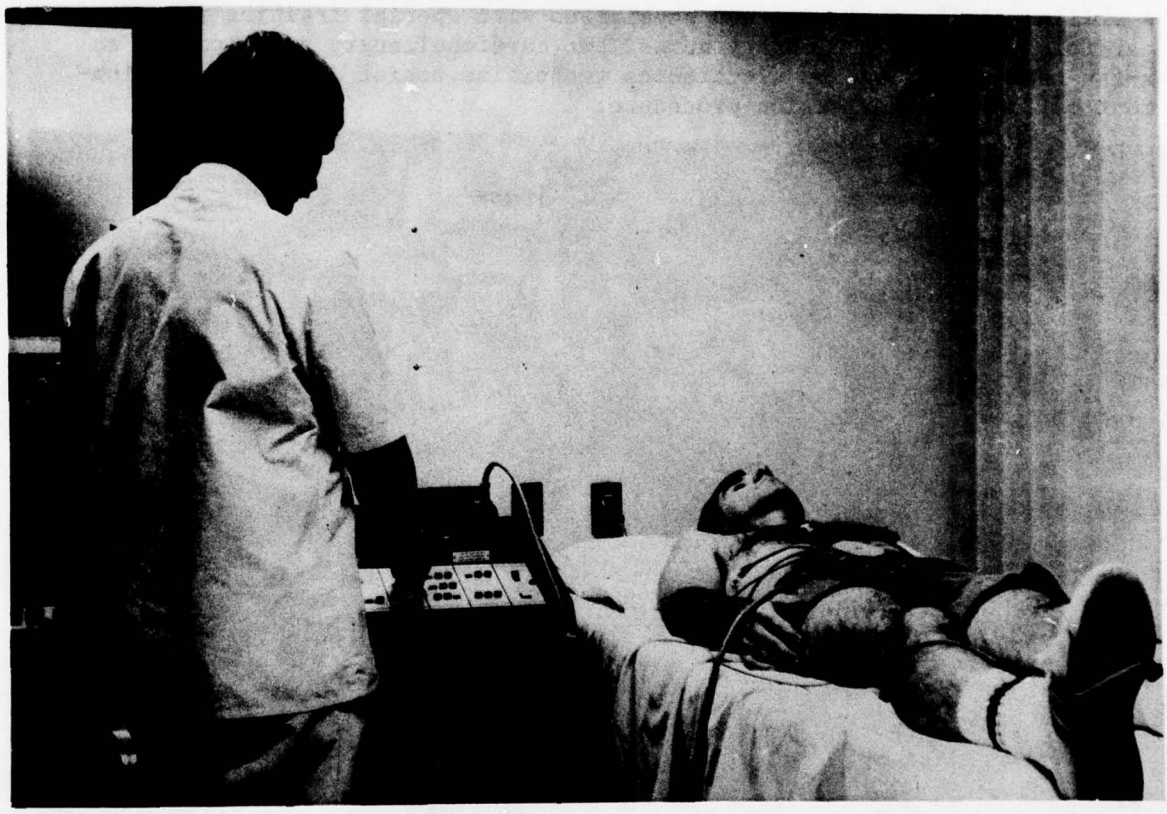
the direction and relative magnitude of electrical forces generated during cardiac activity. The patient is prepared by placing silver electrodes on the skin at selected sites. Skin impedance must be kept at 10,000 ohms or less between electrodes when checked with an electrical impedance meter.

Technical Information

Hewlett Packard 1570C programmer and 7860 monitor with Polaroid camera Information from Hewlett Packard programmer fed to recorder through signal conditioning amplifiers

Tektronix oscilloscope type RM 564 to monitor signals before and after recording

Ampex 2200 recorder with magnetic tape for information storage



Vectorcardiography

CARDIAC CATHETERIZATION LABORATORY

General Information

The occurrence of a heart attack in an Air Force pilot at the controls of an aircraft could result in disaster. Therefore, the early detection of latent coronary artery disease is a prime mission of the Division and its Aeromedical Consultation Service. The majority of the patients referred from throughout the Air Force are sent to USAFSAM for evaluation of cardiac problems. Coronary arteriography is the definitive procedure for evaluating the anatomic condition of the coronary arteries and hence the method of choice for diagnosing coronary artery disease, the leading cause of death and disability within the American adult male population. The procedure consists of the injection of a radiopaque dye into the left ventricle and selectively into the major coronary arteries, via a small cardiac catheter introduced through an artery in the arm or leg. Motion pictures are made of the procedure on 35mm film under direct fluoroscopic observation. The average procedure requires 30-40 minutes. A skilled staff, including two physicians with special training in cardiology, a cardiopulmonary nurse, two cardiopulmonary technicians, an x-ray technician, and an electronics technician assist in the accomplishment of the catheterization procedure.

Cardiac Catheterization Laboratory

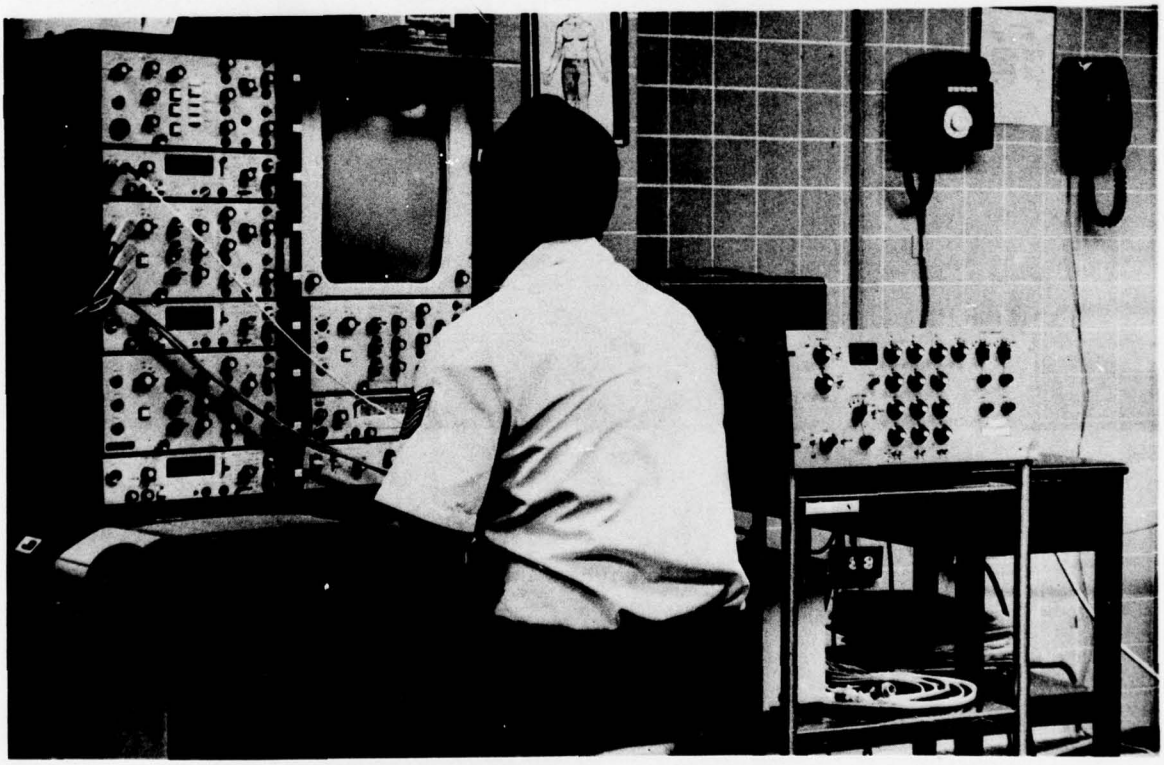
CLINICAL ELECTROPHYSIOLOGY LABORATORY

General Information

Functioning as an adjunct to the Cardiac Catheterization Laboratory, the Clinical Electrophysiology Laboratory utilizes intracardiac recordings of electrical activity from the evaluation of arrhythmias and conduction abnormalities that might lead to sudden incapacitation. Multiple electrode catheters are positioned strategically inside the heart under fluoroscopy. The signals are processed through a physiologic recorder and stored on magnetic tape. A programmable stimulator allows the introduction of appropriately timed electrical impulses to the heart that are capable of both evaluating the integrity of the conduction system and potentially reproducing a significant arrhythmia.

Technical Information

E for M VR-12 physiologic recorder
Ampex 2200 14-channel tape recorder
Bloom programmable stimulator



Electrophysiology Laboratory

Recovery Unit

Three ESPL recovery units are available for the close observation and monitoring of patients following cardiac catheterization. Medical technicians, specially trained in electrocardiographic monitoring and emergency cardiopulmonary resuscitation, man the unit.

Recovery Unit

ORTHOSTATIC STUDIES

Patients with previously reported or expected decrements in orthostatic tolerance are given a Tilt Table test. This test involves 10 minutes of quiet, supine rest followed immediately by 20 minutes of 70° head-up tilt. Patients are passively moved to the tilted position by a motorized mechanism. Tilt Table testing is also done on patients before and after some intervention (i.e., drug studies) to evaluate the effect of the intervention on orthostatic tolerance.

Orthostatic Studies

PULMONARY FUNCTION

General Information

The Pulmonary Function Laboratory is responsible for determining the lung and gas exchange status of consultation patients. Two computerized lung modules are used to assess parameters of air flow, lung elastic recoil and volume, diffusion capacity, and distribution of ventilation. Static and dynamic tests such as these allow the physician to quantify how well the aircrew member can extract needed oxygen from air at various altitudes and under different conditions of stress.

Using other noninvasive tests, such as oximetry and blood gas analysis, statements can be made about the oxygen-carrying capacity of blood to the tissues. This Function also supports the Cardiac Catheterization Laboratory by performing cardiac output determinations. Basic pulmonary research is conducted, investigating how well-inspired air is distributed in the lung and the effect of smoking on gas exchange.

Technical Information

Ohio 2300 Lung Modular System. Includes 842 Spirometry, Ohio 720 CO Diffusion System, Hewlett Packard 7040A X-Y Recorder, and Ohio 700 Nitrogen Analyzer.

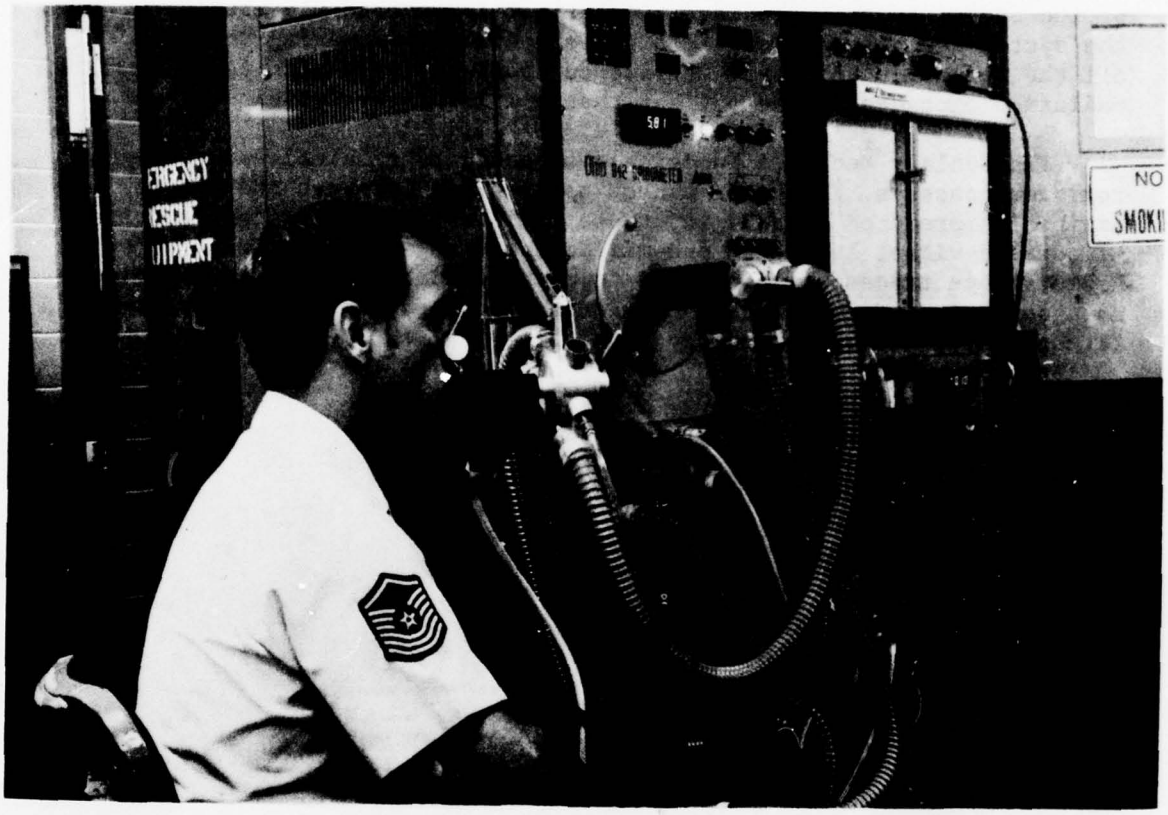
System uses a waterless piston seal spirometer to derive volumes. Flow rates are derived electronically from primary volume transducers. Analyzers in the system are used to measure concentrations of carbon monoxide, helium, and nitrogen for different tests.

Collins P1265 Lung Modular System. Includes Collins water spirometer with convertible 7 liter or 14 liter bells, Lira carbon monoxide analyzer, and Collins helium cathrometer.

System uses bell displacement to measure volume with kymograph to record and measure flows and volumes.

Corning 165 pH/Blood Gas Analyzer. Instrument measures O_2 by a Clark type electrode. A Severinghans stow-type electrode measures CO_2 and a flow-through glass capillary and reference assembly measures pH.

American Optical Oximeter II. Instrument uses change in optical density to measure oxygen saturation in blood samples.

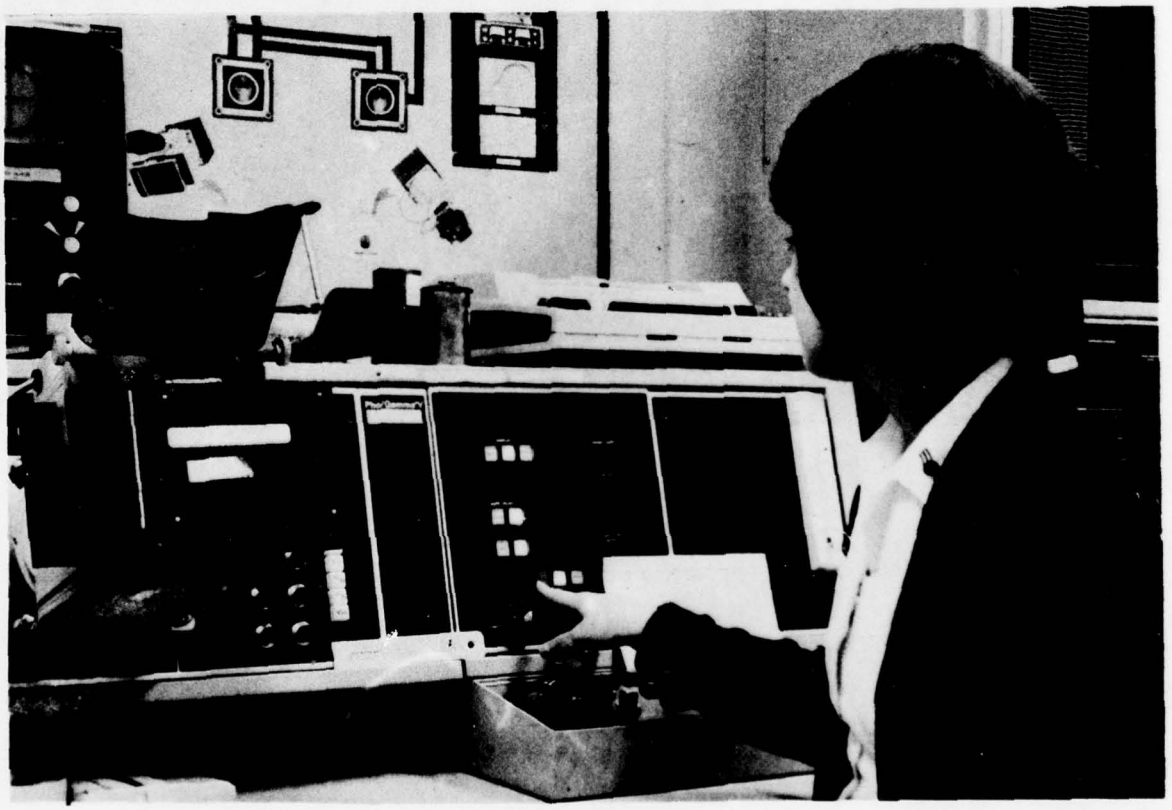


Pulmonary Function

NUCLEAR MEDICINE

The Nuclear Medicine Function supports the Clinical Consultation Service with a wide range of dynamic and static radioisotope imaging procedures. Utilizing an Anger Gamma-Ray camera and special computer techniques, studies are made of the blood perfusion of the myocardium, cardiac output, and static scintillation images of virtually every organ of the body. In some studies, the patient is coupled electronically to the system and his physiologic signals operate the imaging devices. All the nuclear studies are carried out noninvasively with far less radiation exposure to the patient than similar x-ray techniques.

The Nuclear Medicine Function also conducts clinical and research radioimmunoassays. With the use of radioactive hormones and special antibodies produced in animals, these radioimmunoassay procedures can measure in vitro, less than one-millionth of a gram of human hormone. Radioisotope traces are also used to measure blood components and blood changes during stress situations similar to those found in high performance aircraft and space environments.

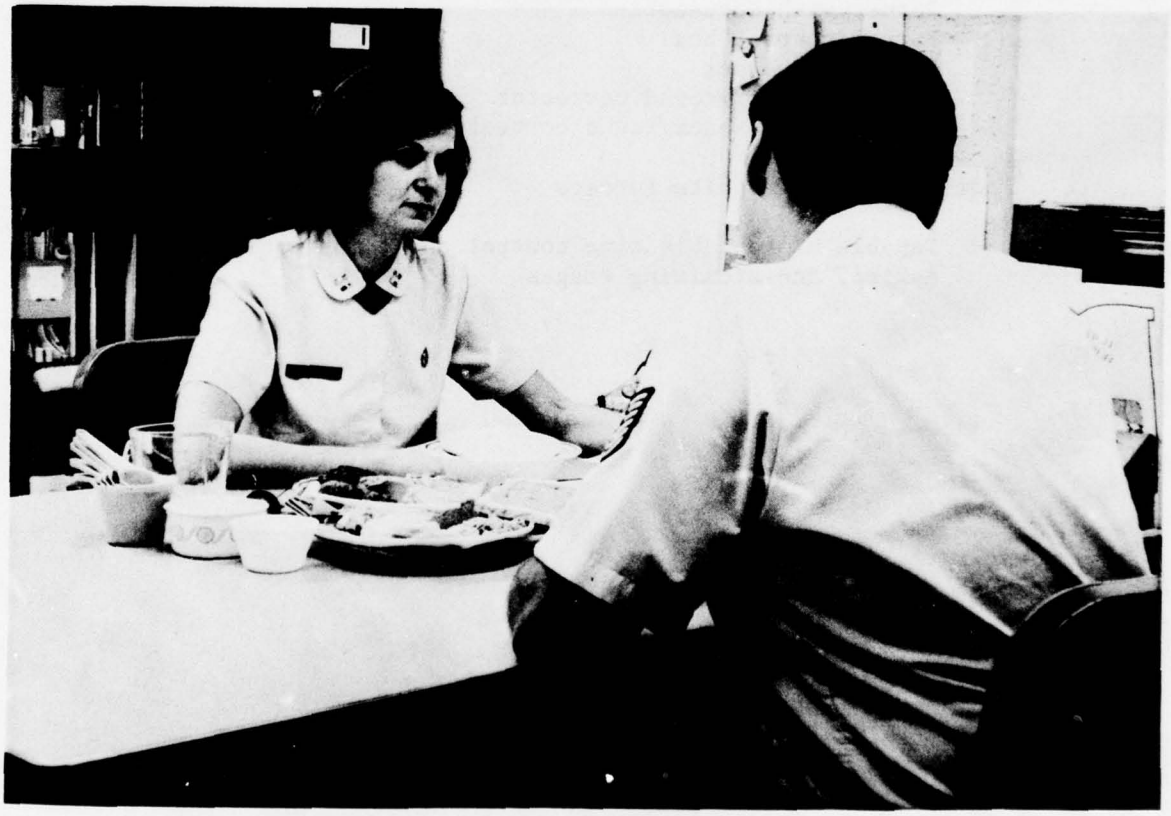


Nuclear Medicine

NUTRITION CONSULTATION SERVICE

A complete assessment of an individual's nutritional needs should be based on laboratory data, physical examination findings, body composition studies, and anthropometric measurements. Based on that information and dependent upon each individual's needs, programs of therapy are planned for consultation patients by a Registered Dietitian and a Diet Therapy Specialist. The patient's work schedule, family situation, activity level, and food preferences are all considered before written and oral instructions are given. The nutritive analysis of dietary records is available from a computerized food composition data set.

Therapeutic diet trays which serve to educate as well as nourish are available for those patients who must remain in-house for procedures. Demonstrations and discussions of current therapeutic diets are provided for physicians and other health professionals.



ATOMIC ABSORPTION SPECTROPHOTOMETER

General Information

This instrument is capable of determining trace quantities of approximately 40 elements. Current research is seeking to correlate levels of trace metals in biologic samples with cardiovascular disease in man. (Experimental evidence shows that an induced chromium deficiency, for example, results in diabetes and atherosclerosis.)

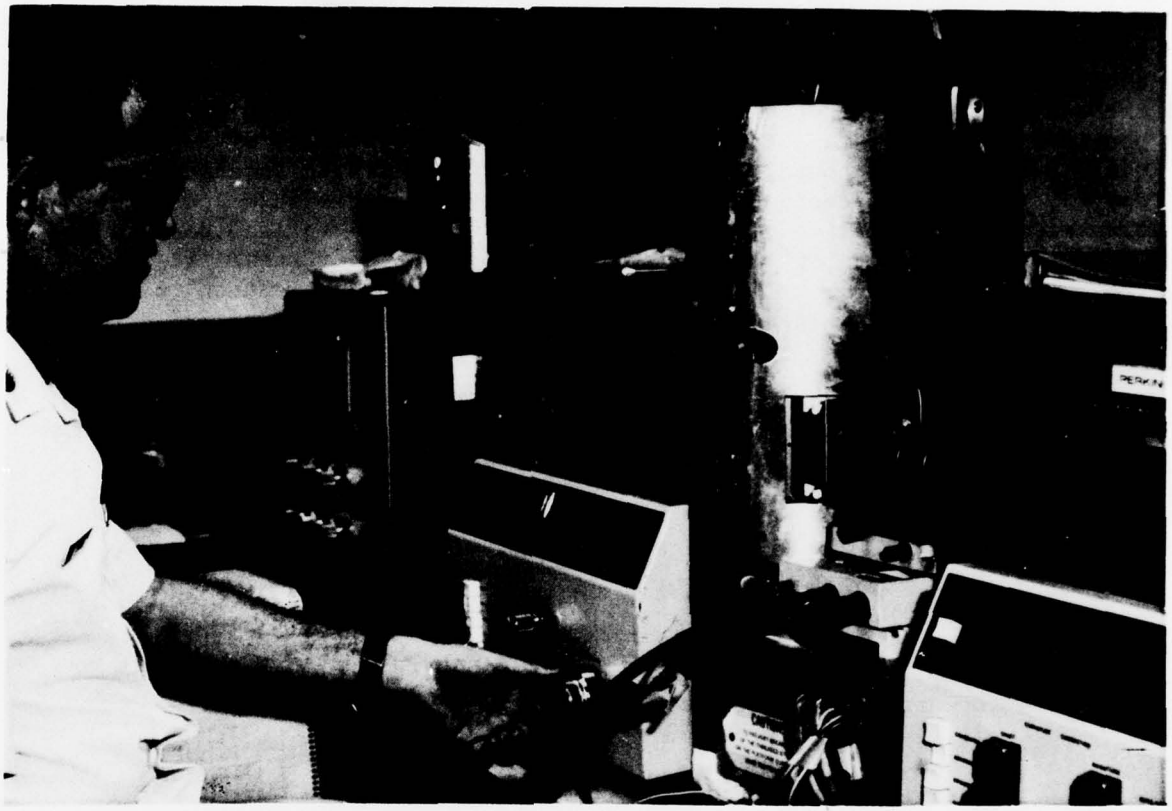
Technical Information

Perkin-Elmer Model 503 Atomic Absorption Spectrophotometer

- Wide-range and window photomultiplier detector
- Double beam photometer
- Self-contained electronic digital readout
- Automatic zero control
- Curvature and signal correction
- Burner with accessories
- Burner control box
- Emission chopper
- Deuterium background corrector
- Quartz iodine background corrector

Model HGA 2100 Graphite Furnace

- Capable of variable time control and temperature in the drying, ashing, and atomizing stages



Atomic Absorption Spectrophotometer

ANALYTICAL ULTRACENTRIFUGE

General Information

The analytical ultracentrifuges provide capability for the measurement of sedimentation rates and molecular weights of proteins, as well as for measurements of concentrations of lipoproteins. These measurements may be accomplished by either a built-in Schlieren optical system and camera or a specially attached photoelectric scanning system. The Schlieren optical system and camera require sequential photographs of the sedimentation boundary whereas the photoelectric scanning system provides electronic facilities for an instantaneous readout of protein distribution and of boundary position. The photoelectric scanning device, of in-house design and fabrication, provides readouts for light transmission, optical density, first derivative of the optical density curve, and cumulative optical density as a function of distance from the base of the cell. It is equipped with a prism monochromator to vary wavelength of emerging light from 2000 to 200 nm.

Technical Information

Dimensions

Net weight of instrument: 2400 lb
Floor: 27 x 72 in.
Overall height: 84 in.

Drive unit

1½ hp., 115-v. water-cooled motor rated at 12,000 rpm drives the analytical rotor through a 1/10-in. piano-wire drive shaft via a gear ratio of 5 1/3 to 1.

Rotor speed variable from 0 to 60,000 rpm

Vacuum system

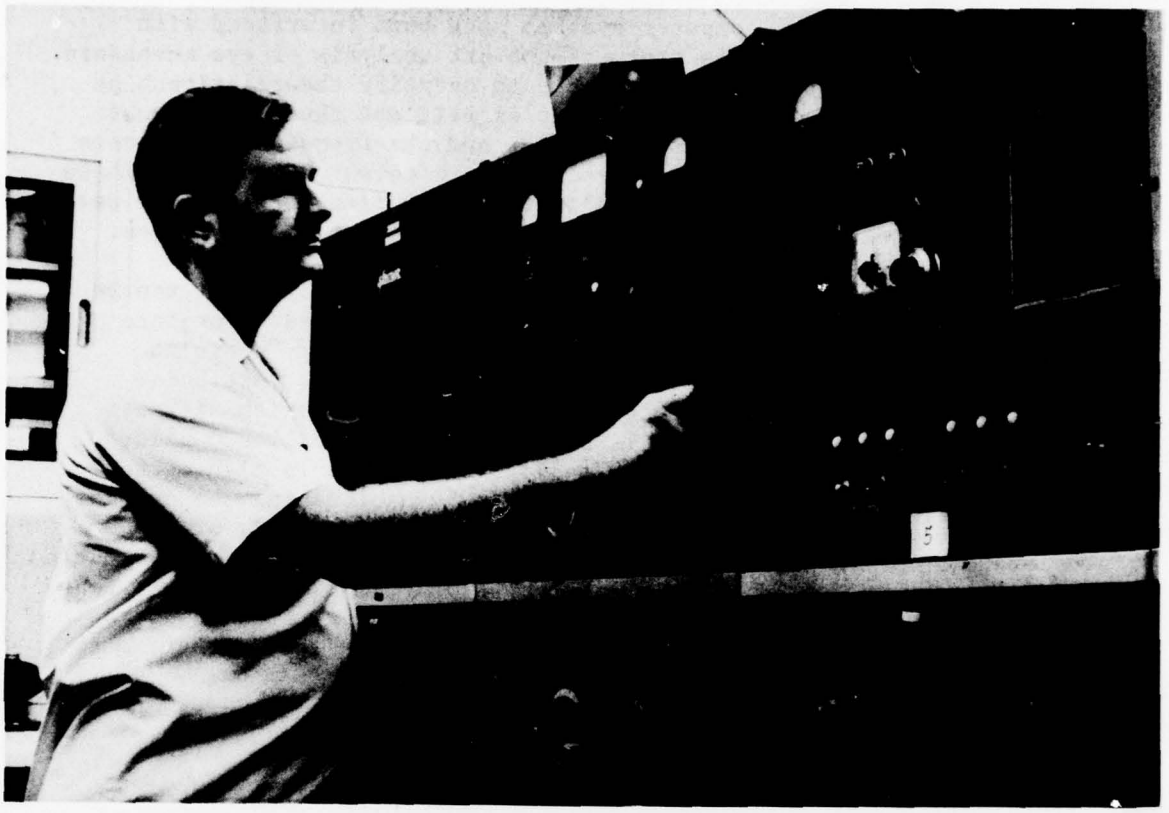
A water-cooled all-metal diffusion pump and two-stage mechanical forepump produce a vacuum of better than 1 μm in which the analytical rotor turns.

Refrigeration

The compressor-type refrigerator permits operation of the rotor at controlled temperatures between room temperature and -15°C within ±1°C of the selected temperature.

Analytical systems

Schlieren optical system and camera with high-intensity mercury arc lamp light source



Analytical Ultracentrifuge

COMPUTER ANALYSIS OF EYE MOVEMENTS

The Vestibular Function supports the aeromedical evaluation of flying personnel by assessing both normal and pathologic function of those portions of the inner ear which respond to angular and linear acceleration. Since stimulation of the inner ear leads to reflexive eye movements, tests are also carried out to determine if the individual has normal oculomotor function.

The Vestibular Laboratory has Z-axis stimulators which have been developed for testing both humans and infrahuman primates. Infrahuman primates have been used as a model in the exploratory development of more quantitative and reliable tests of the vestibulo-oculomotor reflex. The primary objective of this research program is to develop more accurate tests of vestibular function in order to detect peripheral and end-organ damage, eighth cranial nerve tumors, and central nervous system defects related to oculomotor function. Any of these conditions can endanger flying safety.

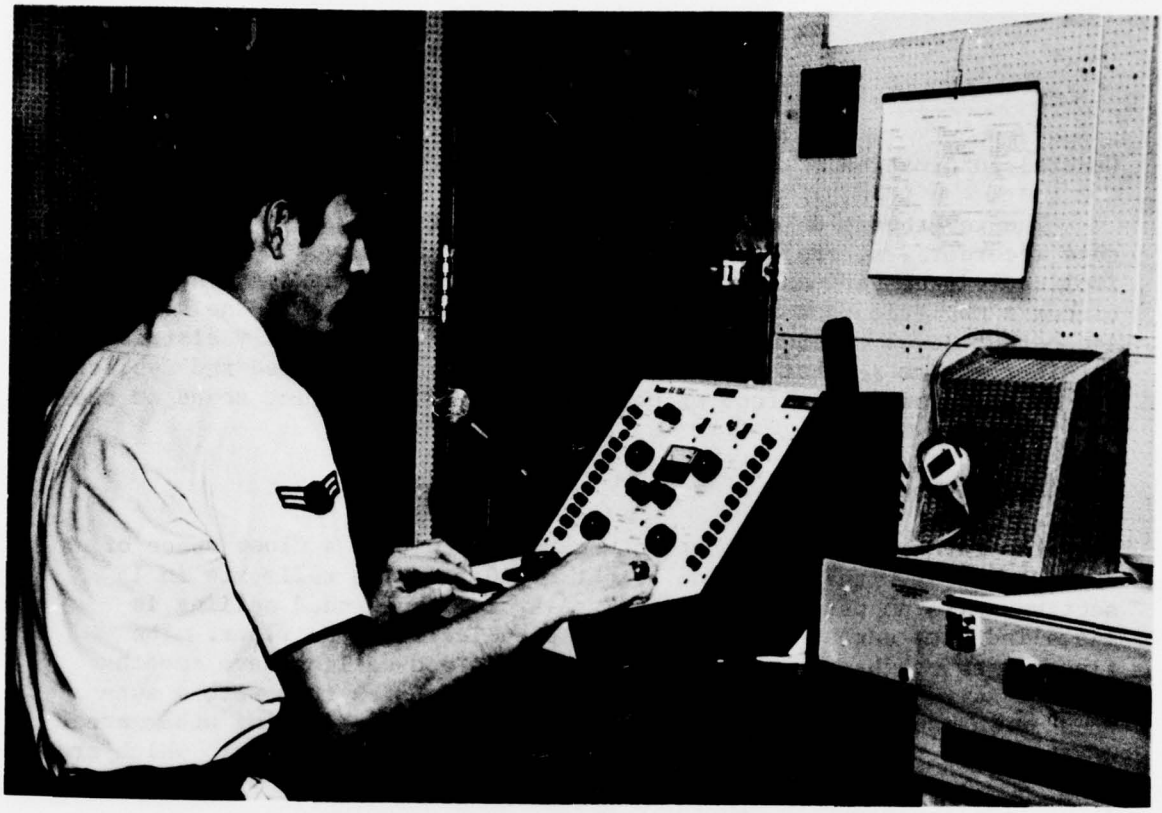
Analog and digital computer systems have been interfaced with recording systems to provide state-of-the-art analysis of eye movements. With the present systems it is possible to quantify the relationships between the vestibular and visual input signals and the eye movement output. Thus, phase relationships, gain, and the frequency components of the reflex can be evaluated and compared to normal standards. These techniques are presently being used in the evaluation of Air Force personnel with complaints referable to the vestibulo-oculomotor system.

The Vestibular Function also has a biaxial turntable that can be accelerated about the Z and X axes. This device is used to produce cross-coupled stimulation of the semicircular canals or "Coriolis stimulation." This type of stimulation causes dramatic vestibular illusions that can easily produce disorientation and motion sickness in human subjects. This device is being used to rehabilitate pilots and navigators who are susceptible to motion sickness in high performance aircraft. This is accomplished by slowly habituating the subject to the stimulus by an incremental increase in the intensity of the accelerations. This is usually carried out over a 2-week period. During this time, the subject also takes part in a program of biofeedback techniques which are aimed at enabling him to identify and then suppress symptoms related to becoming motion sick. This is a joint effort with the Neuropsychiatry Branch.

AUDIOLOGIC EVALUATION

Audiologic evaluation of Air Force personnel is particularly important because of the noise stresses imposed on the ear. For this reason, USAFSAM has a comprehensive auditory test capability. Included are tests to differentiate among conductive, cochlear, and eighth cranial nerve lesions and to categorize types of conductive lesions--e.g., otosclerosis vs. ossicular discontinuity.

Equipment used in clinical testing is installed in a suite containing two sound-treated auditory test rooms. One, a small anechoic chamber, is structurally isolated from the building and provides an area free from ambient masking noise and reflected sound. A two-channel console audiometer is permanently installed to supply test materials via loudspeakers, earphones, or a bone vibrator. The console also contains a tape recorder-reproducer, a phonograph, and various filters. Separate units include a Bekesy audiometer, an automatic audiometer, and a specially designed tone-count audiometric computer. Middle ear impedance audiometry provides the capability for measuring middle ear pressure changes, static compliance of the middle ear and acoustic reflex threshold and decay. The printout, a tympanogram, is produced automatically. Brain stem audiometry, one type of evoked response audiometry, can now be accomplished; this technique is particularly useful for evaluating patients with suspected eighth cranial nerve lesions.



Control Room for Audiology Tests

HEARING CONSERVATION DATA REGISTRY

The Air Force conducts an extensive and comprehensive hearing conservation program for all members who are occupationally exposed to potentially hazardous noise. All such persons are given a hearing test before exposure, 90 days later, and then annually as long as they continue in the noise environment. If a significant hearing change (threshold shift) is noted, the person will receive followup evaluations to determine whether or not continuation of exposure to noise will be allowed. A carbon copy of each hearing conservation audiogram, Air Force-wide, is sent to the USAF Hearing Conservation Data Registry at Brooks Air Force Base. These copies have been arriving at the rate of about 25,000 per month. Data from the forms is transcribed onto magnetic tape for computer processing and storage. This provides a data base which is used to study various aspects of the USAF Hearing Conservation Program. Topics for study include hearing levels by age for military and civilian personnel, acceptability of various threshold shift criteria, comparison of hearing levels for persons in different job specialties, and other topics as indicated.

REVERBERATION CHAMBER

General Information

The reverberation chamber contains loudspeakers, amplifiers, filters, tape recorders, meters, and switching networks for investigating the implications of various noises. Aircraft-type noise can be generated by either a magnetic tape recording of the noise or by a white noise source. A constant level of sound can be maintained and is uniformly distributed within the room so that more than one person can be studied and subjects can move around in the room without significantly altering sound at the ear level.

Technical Information

The reverberation chamber is constructed within a floor space of 20 ft by 14 ft with a vertical height of 10 ft. The walls are in 15 sections with no parallel surfaces. A broken, suspended ceiling is installed with surfaces which are not parallel with the floor. The floor is smooth base concrete, and the walls and ceiling have smooth plaster surfaces. The chamber is encased in a brick room with a surrounding airspace to prevent the intense sound from invading other areas of the building. The room is supported on vibration isolators which are over an airspace. An amplifier which can deliver about 250 watts drives the speakers. A one-third octave band spectrum shaper can be fed with an interval white noise source, a tape recorder, or any other required external signal. Headsets, microphones, jack panels, and switching networks are available for communication between test room and control room. A precision sound level meter and microphone are installed for continuous monitoring of sound pressure level within the room.

ANECHOIC CHAMBER

General Information

A large, quiet, echo-free room is necessary in many investigations involving sound reception. Normal listeners usually have hearing so sensitive that threshold tests are invalidated by acoustic masking unless performed in exceptionally quiet surroundings. An echo-free environment is mandatory for experiments in bone conduction audiometry and for determining attenuation provided by various ear protection devices.

Technical Information

The anechoic chamber has an open working area 10 ft by 12 ft. Walls, ceiling, and floor are covered with sound-absorbent wedges that are 3 ft in depth. The minimum vertical space between the sound-absorbent wedges is 9½ ft. An expanded metal floor is placed 7½ ft

from the top wedges. The wedges are mounted on an 8-in. concrete slab (top, bottom, and sides). The sides and top are surrounded by an 8-in. airspace and then another concrete wall. The bottom is resting on 8-in. vibration isolators which are supported over a 2½-ft airspace. An 8-in. concrete slab is under the airspace and over another 2½-ft air space. A steel plate bridges the airspace at the doorway; when this is removed, mechanical isolation of the room is complete.

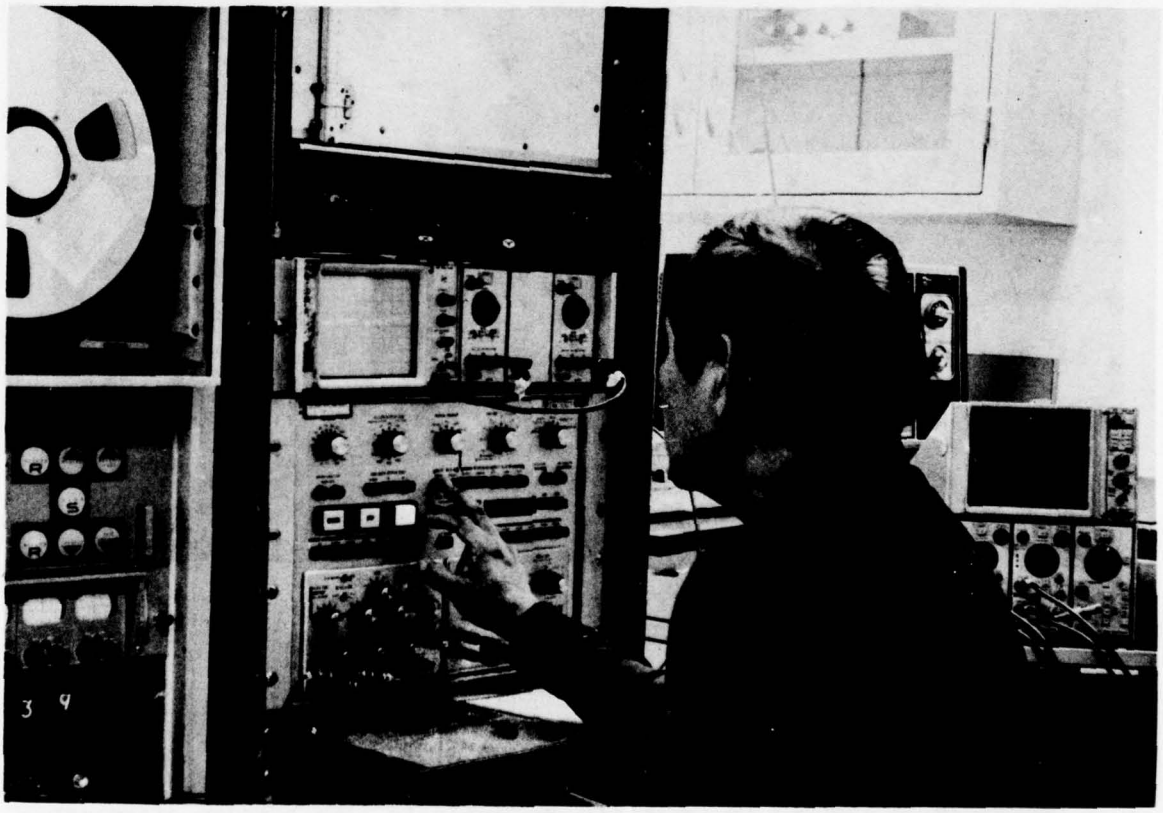
Anechoic Chamber

COLOR VISION TESTING

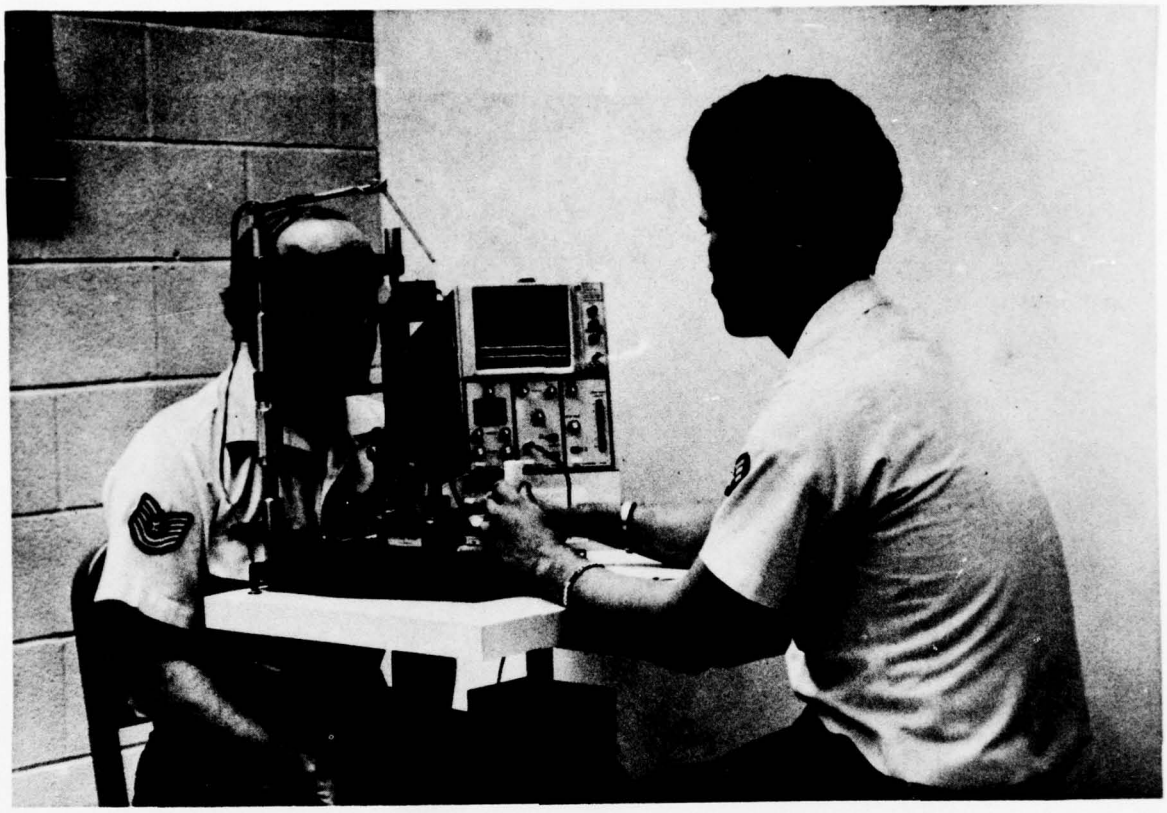
An array of testing equipment is available to make precise diagnoses of color vision defects in flying personnel. Special diagnostic color vision tests include the Farnsworth-Munsell 100-Hue Test, the Farnsworth Dichotomous Test (Panel D-15), the Farnsworth Navy Lantern, the Nagel Anomalyscope, and the Lovibond Automated Tintometer.

VISUAL ELECTRODIAGNOSTICS

Capabilities exist for dark adaptometry, electro-oculography, electroretinography, visually-evoked responses, and a-scan ultrasonography. Night vision of flying personnel is evaluated with the Goldmann-Weekers dark adaptometer. Arden light/dark ratios are calculated using a ganzfeld stimulator and bicanthal skin electrodes used in determining the ocular standing potential in clinical electro-oculography. Contact lens electrodes are used to record the biphasic electroretinogram elicited by a transient light flash in a ganzfeld. Visually-evoked responses are recorded on an averaging computer to either transient or steady-state stimuli. A Digital Biometric Ruler allows axial length and crystalline lens thickness to be determined with accuracy. These specialized procedures supplement and complement clinical evaluation in the diagnosis of eye disease.



Averaging Visually-Evoked Potentials

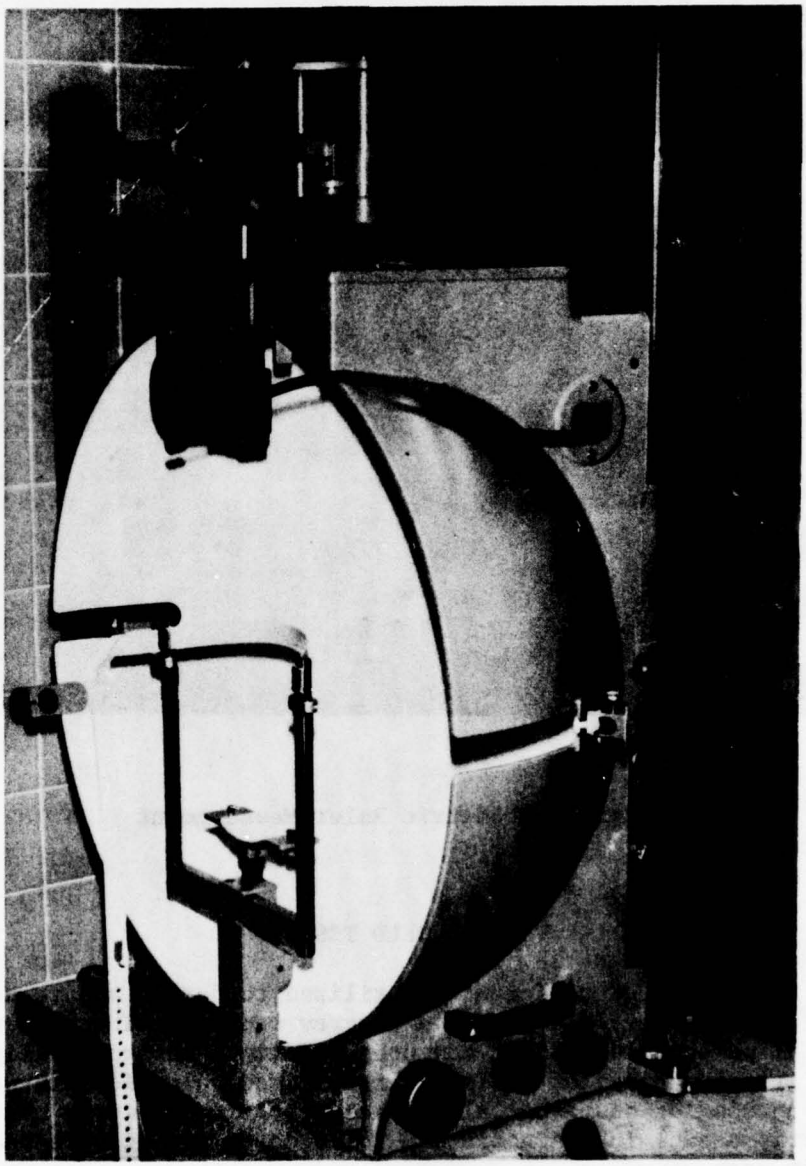


Digital Biometric Ruler Measurement

VISUAL FIELD TESTING

The most advanced equipment is utilized to detect and to define the presence of visual field defects in aircrew members. The presence of an abnormal blind spot in a pilot may pose a serious hazard to flight operations. Careful mapping of a field defect gives valuable information regarding ocular or neurological disease. Static perimetry has been particularly useful in diagnosis and followup of flying personnel with macular disease.

The Goldmann Projection Perimeter utilizes a hemispheric test field with white and colored spots of light as test objects. Data are recorded in a semiautomatic fashion. With this instrument, both kinetic and static tests can be conducted.



Goldmann Perimeter

FUNDUS CAMERA

Photographs of the interior of the human eye provide valuable documentation of ocular and systemic disease. The program or resolution of retinal disorders can be objectively demonstrated. Photographs provide baseline data for later comparison by specialists at USAFSAM or other medical facilities. This procedure has been very useful in the evaluation of flying personnel with ocular problems.

A Zeiss fundus camera, a highly modified indirect ophthalmoscope, is utilized in combination with a strobe light placed coaxially with the viewing light. One can also obtain fluorescein cinematography of the interior of the eye, demonstrating blood flow through the fundus vessels, and detecting any impairment of flow or leakage of fluid.

Fundus Camera

CONTACT LENS LABORATORY

The School of Aerospace Medicine is the only facility authorized by the United States Air Force to fit contact lenses for flying personnel. The use of contact lenses in aircrew members is strictly limited to conditions of the ocular cornea which cannot otherwise be corrected. The laboratory is equipped with lathes and polishers that can be used to fabricate lenses directly from a plastic block. Radiuscopes, lensometers, and magnifiers are available to examine new and old lenses.

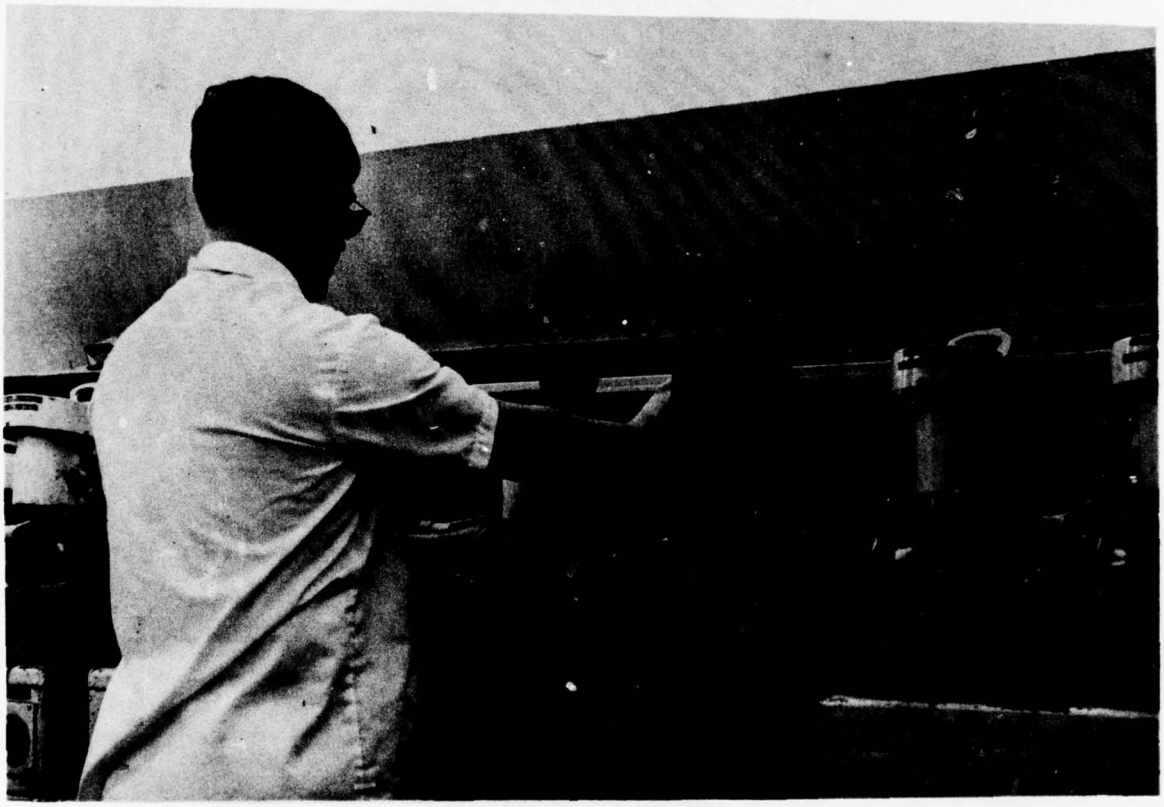
Contact Lens Laboratory

PHOTO-COAGULATOR

This instrument is used in retinal burn and flashblindness research activities involving experimental animals. The xenon arc in the instrument produces sufficient energy to coagulate the retina of the eye. The light energy is focused onto the fundus with an ophthalmoscope that is part of the coagulator. Heat ranges and pupillary apertures can be selected to give the optimum amount of energy needed.

RESEARCH OPTICAL UNIT

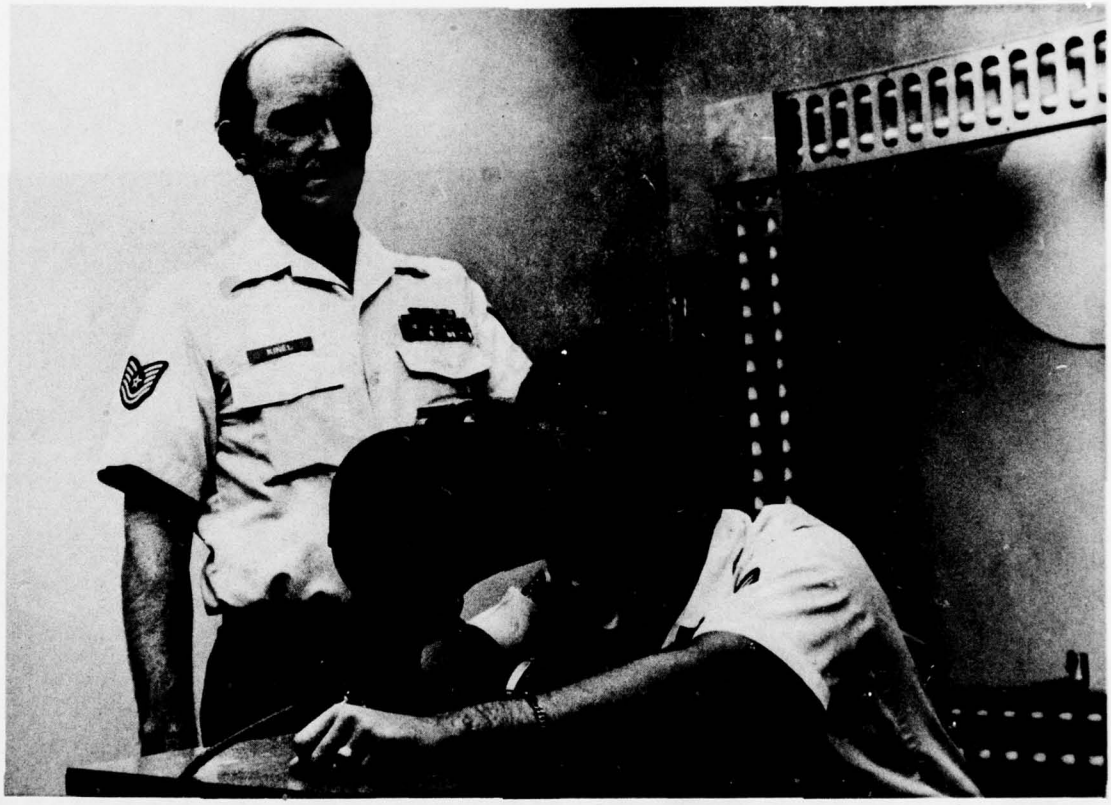
The USAF School of Aerospace Medicine is the site for the only ophthalmic fabrication facility in the United States Air Force. The laboratory has the capability of designing and producing optical devices for application in the flyer's environment, as well as filling any spectacle prescription on an emergency basis. State-of-the-art frame and lens materials are tested in the Research Optical Unit for specific Air Force applications.



Lens Polishing Operation

SPATIAL PERCEPTION LABORATORY

A clinical facility is available at the USAF School of Aerospace Medicine to evaluate binocular performance and spatial perception problems. In addition to standard stereopsis instrumentation, a variable speed motorized Howard-Dolman and a space eikonometer are employed in patient work-ups.



Space Eikonometer

X-RAY LABORATORY

The SAM x-ray facility assists the School in the evaluation of patients as well as in research projects. Support is also given to the Brooks Air Force Base Clinic. The facility performs routine x-rays, as well as fluoroscopic procedures and intravenous pyelograms.

NEUROPSYCHOLOGICAL LABORATORY

The Psychology Function of the Clinical Sciences Division utilizes the Halstead-Reitan Neuropsychological Test Battery for assessing performance of patients with questionable brain damage. The function has developed and utilizes an automated system using a microcomputer. This system provides a standardized method of administration, scoring, data recording, and additional performance measures not available from the manual administration of the Halstead-Reitan. This test battery provides data not only as to the probability of the presence or absence of brain damage but also some indices as to the lateralization and localization of such damage in the cerebral hemispheres. The increased sensitivity of the present clinical instrument is believed to afford the most valid measurements in identifying abnormal performance due to cortical dysfunction.

Halstead-Reitan Automated Neuropsychological
Test Battery

DENTAL INVESTIGATION SERVICE

General Information

As of 1 October 1976, with the publication of AFR 162-7, the Air Force Dental Investigation Service was established to provide investigative guidance and assistance for all U.S. Air Force dental personnel. The Service consists of clinical, laboratory, and consultant capabilities maintained as an integral part of the USAF School of Aerospace Medicine. The Service has been set up specifically to provide a capability for solving operational problems identified by Air Force dental activities and by the Office of the Surgeon General. It develops methods, techniques, procedures, equipment, and materials especially designed to support Air Force dental clinical operations. It also tests and evaluates dental equipment, materials, and procedures that are programmed to support the Air Force Dental Service mission. The Dental Investigation Service acts as liaison for Air Force Medical Centers and dental training programs in providing technical assistance for investigations that contribute to the training programs in biomedical services. Under its auspices, Air Force dentists receive training in current preventive dentistry techniques and receive guidance concerning Air Force Dental Health Programs.

Technical Information

The Dental Investigation Service (DIS) builds its test and evaluation capabilities in response to tasking by the Assistant Surgeon General for Dental Services. At present DIS can respond to requirements for physical/mechanical testing of metallic and nonmetallic restorative materials in tensile, compressive, and diametral modes. Full testing capability of dental high-speed handpieces including power, vibration, concentricity, chuck retention, cooling ability, and noise, as well as testing of dental diamond rotary instruments to include grit retention, concentricity, corrosion resistance, and shank topographical analysis is now available. Two dental treatment rooms (DTR's) are available for installation of equipment (chair-units) for test and evaluation (T&E) of technical and clinical functions. Scheduled increases in T&E capabilities include operating light analysis, a DTR design laboratory for equipment/casework evaluation and determination of optimal layout configuration, and a fully operational laboratory for T&E of nonprecious dental casting alloys for use as gold substitutes in fixed partial prosthodontics.

CREW TECHNOLOGY DIVISION

The Crew Technology Division manages research and development programs to establish criteria, standards, and optimal configuration of crew protective equipment; to determine and optimize the effects of mission environments on crew readiness; and to enhance the utilization of crew resources. Special equipment and facilities make possible a combined capability for research on environmental factors essential for life at extreme altitudes; physiologic tolerance studies under varying pressures, temperatures, and atmospheric compositions; metabolic requirements; tolerance limits and physiologic and biochemical responses to high gravitational stress, simulated air combat maneuvering G stress, and other in-flight stresses; development and biomedical criteria for oxygen supply systems; environmental quality criteria and control of noxious materials; and assessment of stress and fatigue factors.

HUMAN CENTRIFUGE

General Information

The Human Centrifuge is the only operational device of this nature in the Air Force which is capable of in-depth physiologic evaluation of man exposed to gravitational stress. Namely, it is the only centrifuge with closely located pulmonary, blood gas, and cardiovascular facilities specifically designed to monitor human physiologic response to increased gravity conditions. It has elaborate instrumentation capabilities and a fully trained, highly qualified team of medical scientists, physicians, and technicians to operate it. This facility has as its utilitarian objective the following purposes:

1. Define the objective endpoints to increased gravitational stress in human subjects.

2. Define optimum seating configuration (positioning) for human subjects when exposed to high gravitational stress imposed in the $+G_z$ or $+G_x$ directions.

3. Interpret a cross-correlation of objective endpoints using experimental animals to either extend or validate the previously determined human physiologic data.

4. Evaluate and cross-correlate the physiologic parameters using new sensing devices.

5. Provide a vehicle for the evaluation of selected Air Force flight personnel whose medical condition may preclude their remaining on flight status.

6. Provide a means for acceleration indoctrination for pilots and other rated personnel.

7. Provide an experimentally controlled simulator for basic and applied research concerned with the effects of acceleration on the function of separate organ systems or on the total system in live experimental subjects.

8. Provide a test vehicle for acceleration sensitivity determination of experimental and flight aircrew protection hardware and instrumentation.

The centrifuge consists basically of a pump and motor control center, pipe tunnel, drive motor subpit area, and the centrifuge pit area which houses the rotational arm and passenger gondola. On the opposite end of the centrifuge arm is a large animal platform.

The subpit area and pump room house can be continuously monitored from the central control center by closed circuit TV.

The centrifuge has a maximum speed of 94 rpm which can exert 50 times the force exerted by the earth's gravitational attraction (50 G) on a subject or equipment located in the gondola at the end of the arm. In a typical run or "profile," the centrifuge is accelerated to a specific G level within a prescribed time limit. By the use of maximum pumping pressure (5,000 psi), full speed can be reached in 50 seconds. Onset to 20 G can be accomplished at the rate of 2 G per second. Thus, the average run requires only a few seconds at high pressure to reach normal operating conditions.

Technical Information

Centrifuge Arm

Overall radius: 23 ft

Construction: Cantilever (monohedral)

Natural frequency: without gondola, 6 Hz

Horsepower rating: 850 hp constant

Speed control: electrically driven--infinitely variable

Onset control: electronic pressure (Torque) control infinitely variable

Braking: infinitely variable hydraulic brake pressure, an air-actuated brake, or a combination of both

Slip rings: 110 for biomedical instrumentation, 90 for the electrical control circuits

Auxiliary equipment: closed circuit television; continuous voice contact with subject; x-ray capabilities available for human and animal experimentation; remotely controlled vascular injection or withdrawal; air pressure for anti-G valve testing; and strip chart and magnetic tape recording.

Two-man gondola--closed cylinder gondola

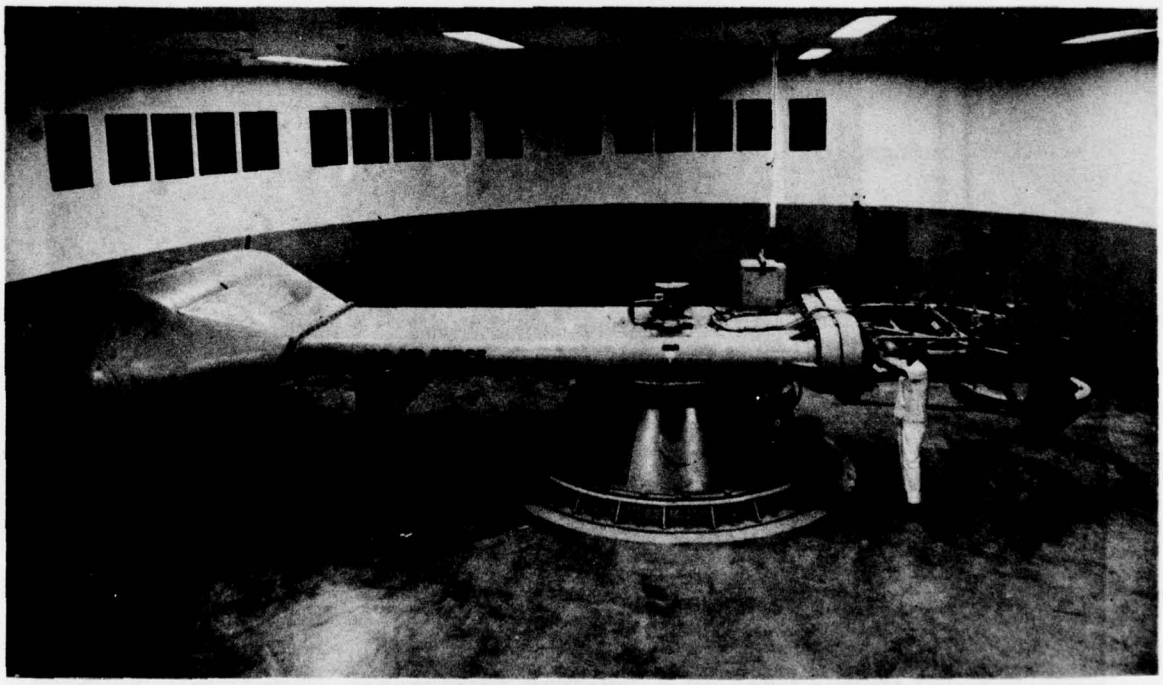
Diameter: 6 ft

Length: 9 ft

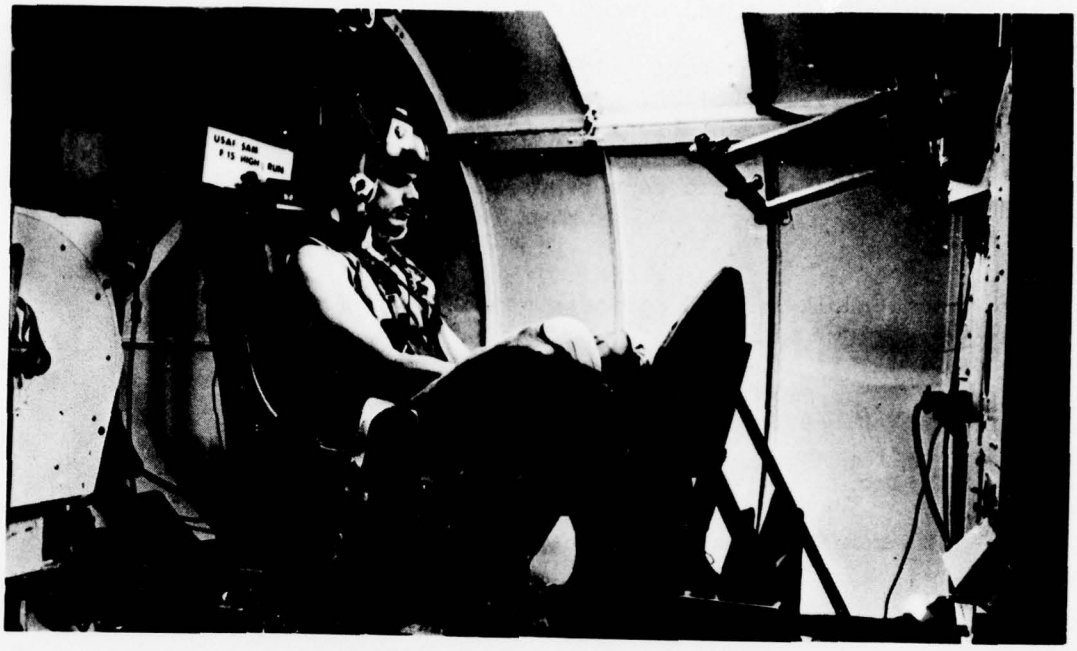
Control: 90^{o} rotation (passive)

Maximum G at maximum radius: 50 G

Payload: 30,000 G lb



USAFSAM Human Centrifuge



Centrifuge Gondola

Centrifuge Control Room

SMALL ANIMAL CENTRIFUGE

(SHORT TERM)

General Information

The short-term centrifuge is completely encased in a "metal housing" which is closed, for protection of the experimenters, during centrifuge operations. The centrifuge is designed for high G operation although low-level accelerations are possible. The animal is restrained by cage or couch which is fixed upon the magnesium platform at the desired radius and acceleration vector. Acceleration exposures of 10 min or less are conducted with this unit. Animals of 20-lb (9.072 kg) body mass or less would be most advantageously used for experimentation using this centrifuge.

Technical Information

G-range

100 Gs at 46-in. radius

Speed

0-300 rpm

Centrifugal capacity

5,000 G lb

Weight capacity

100 lb

Wow and drift

Within 0.05% per minute including normal line voltage variations, but excluding line frequency variations

Test package size

24 x 24 x 18 in. high

Drive

3 hp, 220/v.a.c., 3 phase 60 cycle

Arm

Balancing with magnesium plates

Accessories

50 slip rings, 5 amp shielded, continous rpm readout

HUMAN BODY VOLUMETER

General Information

This device measures a calculated water volume displacement and is used to determine the body volume of humans. This volume, together with weight and residual lung volume, is used to calculate the kilograms of lean and of fat for the individual. The fat and lean body mass is used to determine changes in body composition in the course of research studies.

Technical Information

Dimensions

7 x 3 x 2 ft, with a 4-ft hand rail around the top and a ladder at the rear

Volume of water

Approximately 130 gal

Drum winch

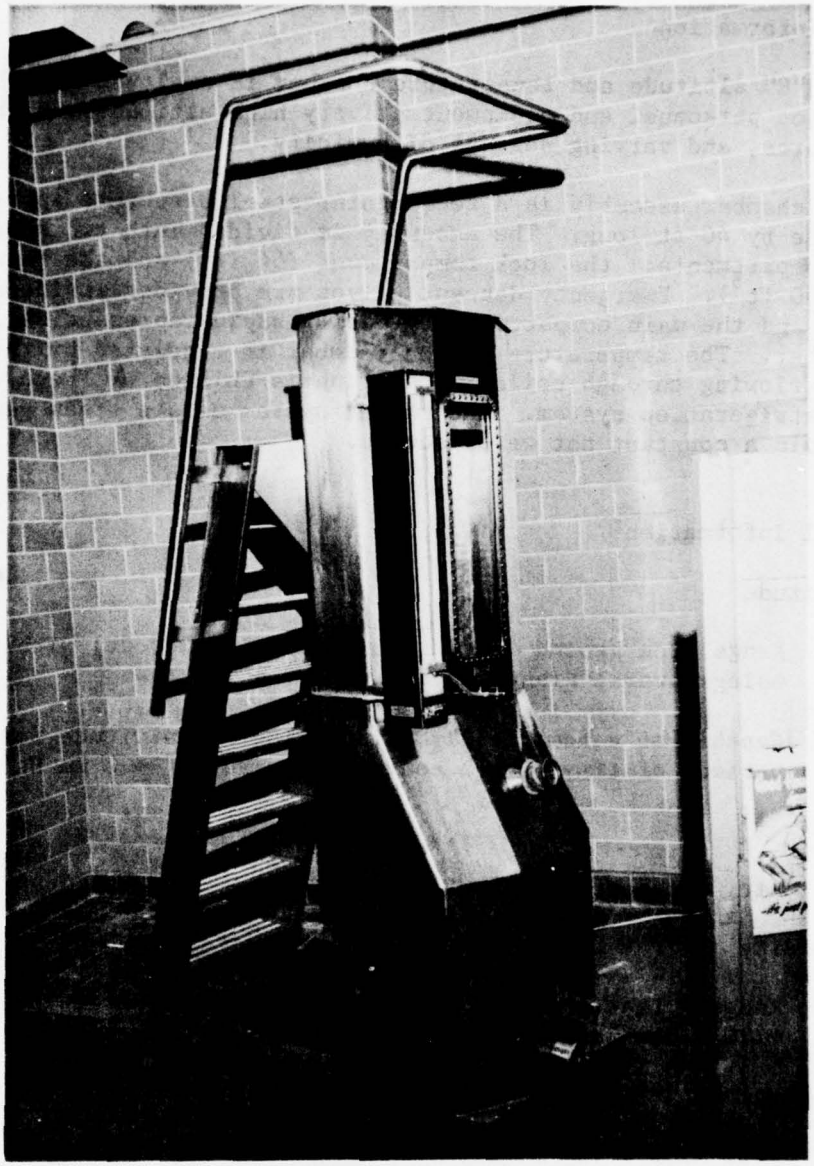
Driven by an electric motor with limit switches at upper and lower positions of the hoist

Illuminated manometer

Attached to the side of the tank

Electric push-button buzzer

Mounted on the side of the tank to inform the subject when to rise to the surface



Human Body Volumeter

THERMAL HYPOBARIC CHAMBER "E"

General Information

The "E" altitude and temperature chamber is employed for physiologic research on personnel and equipment at very high altitudes, high and low temperatures, and varying degrees of humidity.

The chamber assembly is a rectangular steel structure approximately 34 ft wide by 40 ft long. The assembly is divided into two separately sealed compartments: the lock compartment (54 ft^3) and the main compartment (5000 ft^3). Emergency descent valves are provided inside and outside the lock and the main compartment to permit rapid repressurization of the chamber. The temperature in the chamber is regulated by the temperature of brine flowing through coils. The brine is chilled by Freon within a 60-ton refrigeration system. The reheat system uses a steam generator to maintain a constant hot water source.

Technical Information

Altitude

Range from ground level to 8 mm Hg (100,000 ft) within 12 min using several Kinney KD 780 vacuum pumps

Capable of automatically maintaining any altitude for long periods of time with a control accuracy of $\pm$ 2 mm Hg

Gas

Air, CO_2 control only

Humidity

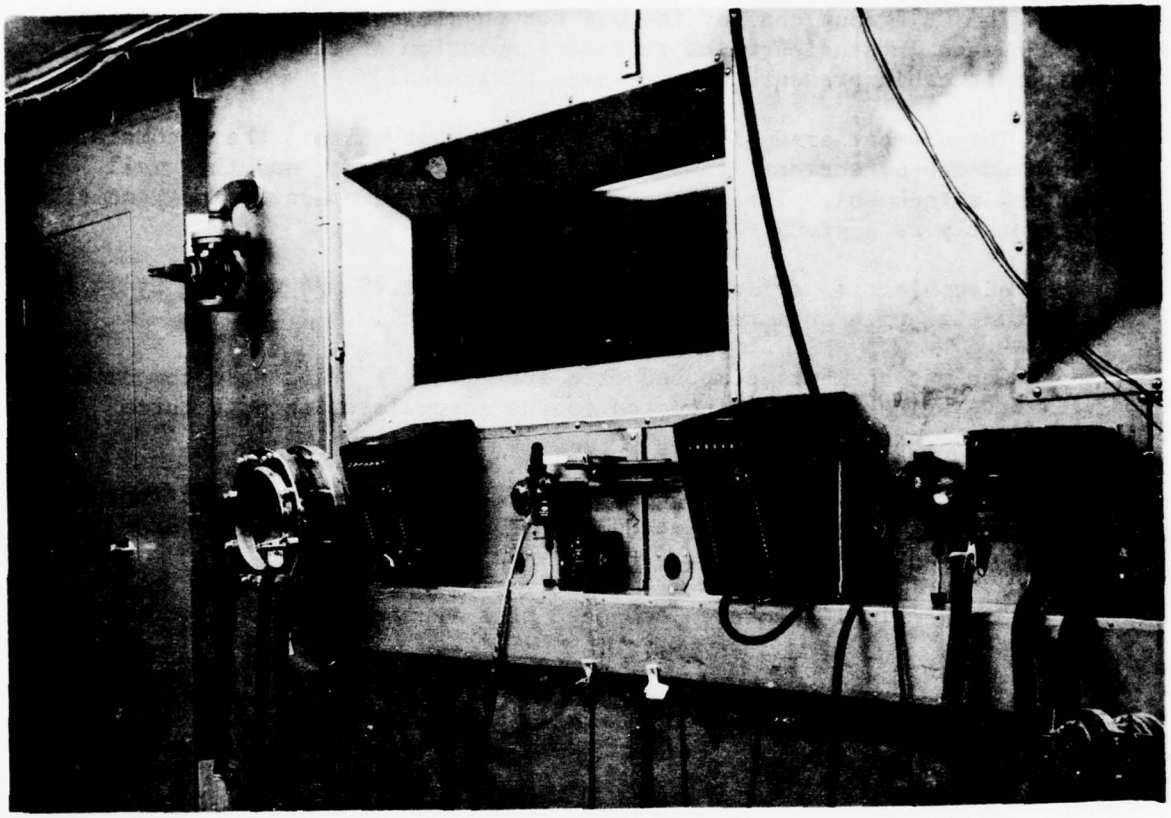
Range: Less than -25°F frost point (<1.5% RH at 75°F) and to +120°F dew point (100% RH at 120°F)

Temperature

From +150°F to -67°F within 12 hours

Fire suppression system

None (Chamber is not used for oxygen atmospheres or other flammable environments.)



Thermal/Altitude Chamber

DECOMPRESSION CHAMBER

(CHAMBER "B")

General Information

The "B" group chamber is used for physiologic research on animals and humans in studies which require simulation of the rapid loss of aircraft cabin pressure at very high altitudes.

The chamber assembly is comprised of four units: the accumulator, the one-man attachment, the large animal attachment, and the small animal attachment. The attached chambers may be operated independently or jointly as a group.

Accumulator: cylindrical steel structure 43 3/4 ft long by 14 ft in diameter with an internal volume of 6311 ft^3.

One-man chamber: composed of a lock (200 ft^3) and main compartment (55 ft^3) which is interconnected to the accumulator through three large decompression valves.

Large animal chamber: composed of a rectangular steel structure (60 ft^3) which is interconnected to the accumulator through three large decompression valves.

Small animal chamber: composed of a rectangular steel structure (35 ft^3).

Technical Information

Altitude

Range: Ground level to 1 mm Hg (150,000 ft)

Control: Auto/manual controls on accumulator only, manual controls on attached chambers

Gas

Air only

Humidity

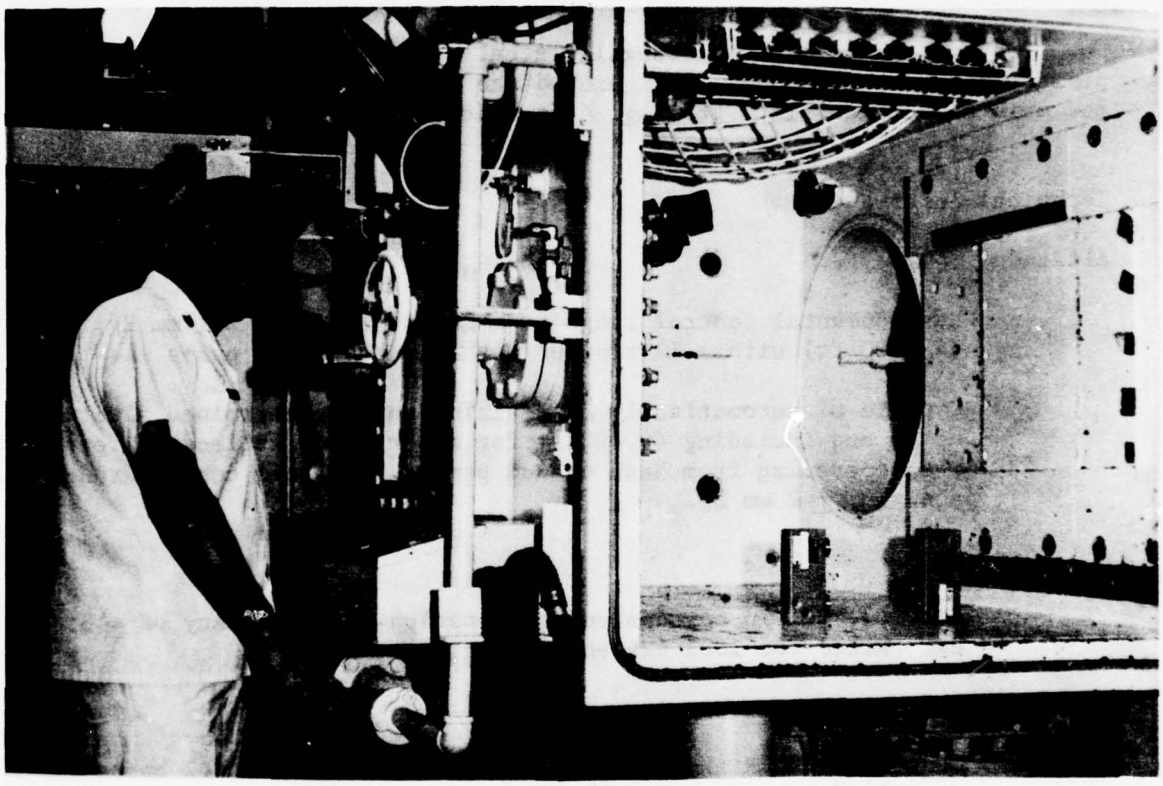
No control

Temperature

No control, vent only

Fire suppression system

None



Rapid Decompression Chamber

RESEARCH ALTITUDE CHAMBERS

(CHAMBERS A-1 AND A-2)

General Information

This "A" group of research altitude chambers (A-1 and A-2) provides a means of exposing laboratory animals to low barometric pressures and different gaseous atmospheres over long periods of time for research purposes.

The two chambers are rectangular steel structures containing one primary compartment with a small hinged man lock. The interior of the main compartment is 7 ft long, 6 ft wide, and 7 1/4 ft high.

Technical Information

Altitude

Environmental control range from ground level to 111 mm Hg (45,000 ft) within 12 minutes with Kinney vacuum pumps

Capable of automatically maintaining any predetermined altitude up to and including 40,000 ft for a period of at least 1 year when operating from Nash vacuum pumps. Pressure control range accuracy $\pm$ 2 mm Hg.

Gas

Air, O_2, CO_2 in any desired combination with accuracy of $\pm$ 3 Hg. Rated for 100% oxygen.

Humidity

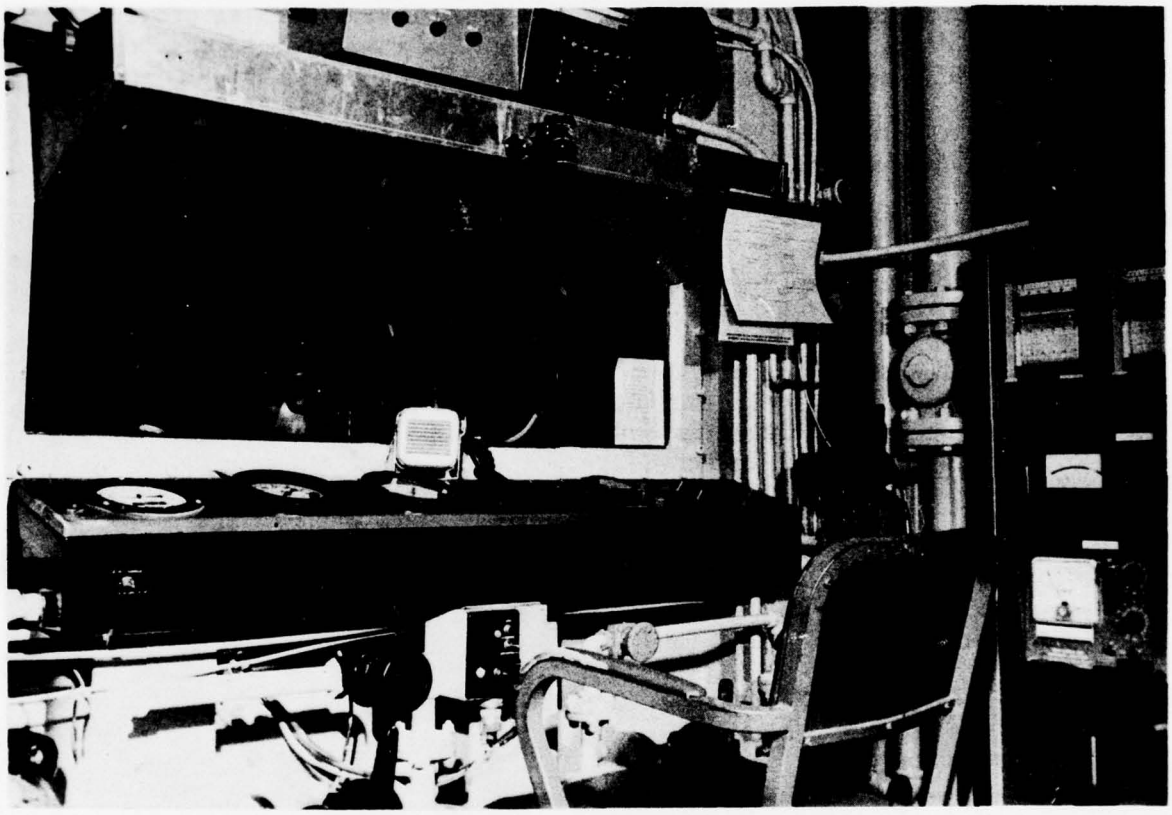
Control $\pm$ 3% RH in comfort zone. Independent control being installed for other levels.

Temperature

Independent control to be installed

Fire suppression system

Automatic and manual water deluge system with UV detection



Research Altitude Chamber

RESEARCH ALTITUDE CHAMBER

(CHAMBER A-5)

General Information

This chamber is a rectangular steel structure containing two compartments, each having interior dimensions of 7 ft long, 6 ft wide, and 7 1/4 ft high. Internal access to either compartment is provided by double doors between the compartments. The compartments may be operated independently or jointly.

Technical Information

Altitude

Range from ground level to 8 mm Hg (100,000 ft) within 12 minutes with Kinney vacuum pump

Capable of maintaining automatically any predetermined altitude up to and including 40,000 ft for a period of at least 1 year when operating from Nash vacuum pumps. Pressure control range accuracy $\pm$ 2 mm Hg.

Gas

Air only

Humidity

Follows ambient room levels upon venting

Temperature

Follows ambient room levels upon venting

Fire suppression system

None (Not man rated for use with enriched oxygen)

RESEARCH ALTITUDE CHAMBER "C"

General Information

The "C" chamber provides a means of exposing individuals to low or changing barometric pressures for physiologic research. It also provides the capability for control of various gaseous atmospheres at any pressure equivalent up to 34,000 ft. It is a rectangular steel structure containing two primary compartments: the main chamber and lock. A secondary personnel passlock is hinged to the lock compartment. Both compartments have a single entry which is closed by a steel door. Access to the main chamber can be made only through the lock. The doors are equipped with drop-away handles which unlock when the chamber is being decompressed. The main chamber has a 20-man (1280 ft^3) capacity and the lock has a 6-man capacity (640 ft^3). The chambers are equipped with emergency descent valves in all compartments.

Technical Information

Altitude

Range from ground level to 8 mm Hg (100,000 ft) within 12 minutes using two KD 780 rotary piston vacuum pumps

Control

Pneumatically pressure-controlled to $\pm$ 2 mm Hg

Gas

O_2 and CO_2 are automatically controlled to within $\pm$ 3 mm Hg of any desired levels.

Humidity

Automatically controlled to $\pm$ 5% RH with a minimal dew point of 32°F. No capability to humidify over ambient levels.

Temperature

No control, vent only

Fire suppression system

Automatic and manual water deluge system with UV detection

TRACE GAS ANALYSIS LABORATORY

General Information

This laboratory possesses a unique capability for trace gas detection. It is equipped with two modes of sample collection and concentration. Analysis technics include gas chromatography with flame ionization (FID) and alkali flame ionization (AFID) detectors, infrared spectroscopy, mass spectrometry, and a liquid chromatograph for high molecular weight compound separations.

Technical Information

Gas Chromatographs

Varian, 2800 (FID)
Varian, 2100 (FID + AFID)
Perkin Elmer, Sigma 3 (FID + AFID)
Tracor 150E (ultrasonic detector)

Liquid Chromatograph

Varian, 8500

Infrared Spectrometers

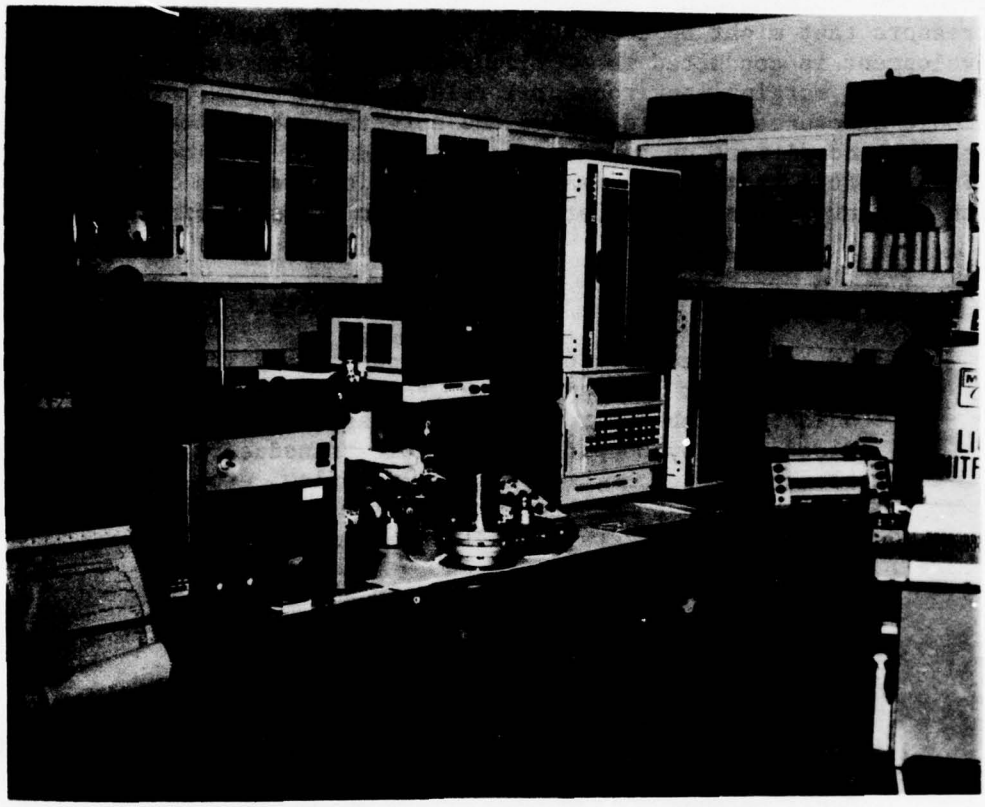
Beckman IR 7
Perkin Elmer 580

Mass Spectrometer

DuPont 21-491 gas chromatograph
Mass spectrometer with DuPont 21-094 data system (Lot #5)
DuPont DP-102
Mass spectrometer

Other

USAFSAM-fabricated cryogenic trapping system for trace gas collection and concentration (0, -78°C, -175°C)
USAFSAM-fabricated sorption tube sampler for trace gas collection and concentration
Ecolyzer (CO) Series 2000 (0-4000 ppm) and (0-500 ppm)
Ecolyzer (NO and NO_2) Series 7000 (0-500 ppm)
Total hydrocarbon analyzer (0-2000 ppm) (Photoionization)
Chemiluminescent NO_x 0-25 ppm
Sulfur analyzer - 0-2 ppm
Hydrocarbon analyzer - 0-25,000 ppm (FID)



Mass Spectrometer in Trace Gas Analysis Laboratory

APPLIED PHYSIOLOGY LABORATORIES

General Information

These laboratories perform experimental investigations in the areas of respiratory, cardiovascular, and aerospace physiology. Emphasis is placed on defining man's responses, tolerances, and limitations to stressors that might be encountered in aerospace environments. Exploratory development is conducted to provide physiologic criteria identifying optimum and marginal environmental relationships under both acute and chronic exposures and to describe the effects of both nominal and emergency conditions on human response for direct application to aerospace life support systems. Nine major laboratories are used in conjunction with the environmental simulators to perform these studies.

Technical Information

On-line real-time computerized cardiopulmonary laboratory
- Channels for real-time data reduction
- Additional channels for data storage
- Blood flow by Doppler or magnetic transducers, blood pressure, electrocardiogram, respiratory gas flow, etc.
- Cardiac output computer
- Blood gas analyzers, ILI 313, Radiometer, Van Slyke
- Blood tonometry
- Gas analysis, O_2 (Beckman E-2 & F-3), CO_2 (Beckman LB-1), Scholander, N_2 (Nitralyzer)
- Treadmill (Quinton Model 18-60E)
- Servospirometers (Collins)
- Wedge spirometers (Collins)
- Chain-compensated gasometer, 120-600 liter capacity (Collins)
- Doppler blood flowmeter - telemetry system
- Oscilloscopes
- X-Y recorders
- 2- to 8-channel recorders

CENTRAL DATA MONITORING FACILITY

General Information

This facility is capable of simultaneously monitoring and recording analog physiologic data from any two of the nine research laboratories in the Biodynamics area, including the Human Centrifuge. The laboratories are connected to a preprogrammable patch panel assembly at the central facility by individually shielded multipair cables. The physiologic analog signals are processed prior to recording by signal conditioners which filter, off-set, amplify, or attenuate the signals as required. Each laboratory has a remote tape footage indicator and complete control of the two 14-channel magnetic tape recorders.

Physiologic data can be visually monitored at all times by viewing an ink oscillograph writeout or by observing the values of the parameters as displayed on digital panel meters mounted on the monitoring facility operator's control panel. A complete digital writeout on paper of an investigator's experiment through a Flexowriter is also possible.

This facility also has the capability to receive, discriminate, condition, and record data from VHF FM/FM telemetry systems. International range instrumentation group (IRIG) time codes, such as IRIG B (fast) and Code "A" (slow), for annotating magnetic tapes or ink oscillograph writeouts, are available to all nine laboratories at all times.

Technical Information

Shielded patchcord programming system

(AMP Inc., Model P-781S)

All inputs and outputs to the laboratories, plus inputs and outputs of all electronic equipment (frequency reject filters, bandpass filters, tape recorders, monitor scopes, signal conditioners, subcarrier discriminators, ink oscillographs, d.c. amplifiers, and digital systems) employed in the facility terminate on this assembly which has a capability for 781 terminations. This system features removable patch panels that can be stored following an experiment and then easily preprogrammed for upcoming experiments.

Two Sangamo magnetic tape instrumentation recorders/reproducers

(Models 4742 and 3562)

14 tracks interleaved with edge tracks A & B

IRIG bandwidth: Intermediate

Reel size: 10 1/2 or 14 in.

Oscillograph (Brush Mark 200 system, Model 2222-1707-111597)

Eight data channels

Three event markers

Frequency response: Flat to 55 Hz full scale and to 100 Hz at reduced amplitudes

System linearity: Exceeds 1/2% full scale

Chart speeds: 10, 15, 25, 30, 60, and 120 mm per second with a divide by 100 feature

PERFORMANCE MEASUREMENT

Laboratory studies on the effects of workload and environmental, physiologic, and fatigue stressors on pilot performance can be accomplished through the use of four specially modified Link GAT-1 light aircraft simulators. A PDP-11 computer continuously scores flying performance during straight and level flight and complex maneuver tests, based on deviations from the programmed flight path. For fixed error thresholds in altitude, heading, airspeed, turn rate, turn coordination, and vertical velocity the computer presents a series of maneuver requests, constituting the flight plan, to the subject on an alphanumeric display mounted in the cockpit. The type and number of maneuvers in the flight plan, as well as its total length, can be modified to suit specific research needs. Typical flight plans last 4.5 hours.

An adaptive, discrete information processing test has also been incorporated into the simulators and can be administered throughout the flight. In minimal time, estimates of perceptual performance decrement can be determined and correlated with changes in flying proficiency.

The GAT-1's have been used in the School's altitude chambers, and the measurement system has been shown to be highly sensitive to fatigue and other stressors. Heart rate and body core temperature can be recorded throughout the flight. In addition, the subject's control movements of elevator, rudder, ailerons, flaps, and throttle can be recorded to analyze integrated tracking error and develop mathematical models of pilot behavior.

INFLIGHT DATA ACQUISITION

The Crew Performance facility operates devices with the capability to monitor and record physiologic and cockpit environmental parameters in actual flight conditions. The devices do not interfere with normal crew activities and are compatible with various cockpit configurations. The devices are formally designated the "Inflight Physiological Data Acquisition System" (IFPDAS) and "Miniature Environmental Monitor" (MEM). Both the IFPDAS and the MEM are portable and battery operated. The units have been used in field studies for the Air Force, Navy, Army, and NASA (Dryden Flight Research Center).

The IFPDAS can be man-mounted or installed on the pilot's side console. It is being used to determine the physiologic cost of stressful flying activities as well as to test and evaluate life support equipment. The MEM is console mounted and is being used to evaluate the thermal conditions in aircraft cockpits to determine the effectiveness of their environmental control systems.

Technical Information

IFPDAS

Dimensions: 2 1/4 x 6 7/8 x 4 1/2 in.
Weight: 2 1/2 lb (1135 g)
Data recorded:

- Inspired ventilation (0-200 liters/min)
- Expired ventilation (0-130 liters/min)
- Inspired oxygen concentration (0-100%)
- Expired oxygen concentration (0-100%)
- ECG (or heart rate only)
- Body temperatures (10 locations)
- Acceleration (-3 to +10 Gs)
- Cabin pressure (0-760 mm Hg)
- Aircraft interphone/radio communications

MEM

Dimensions: 4 1/2 x 6 7/8 x 4 1/2 in.
Weight: 5 lb (2270 g)
Data recorded:

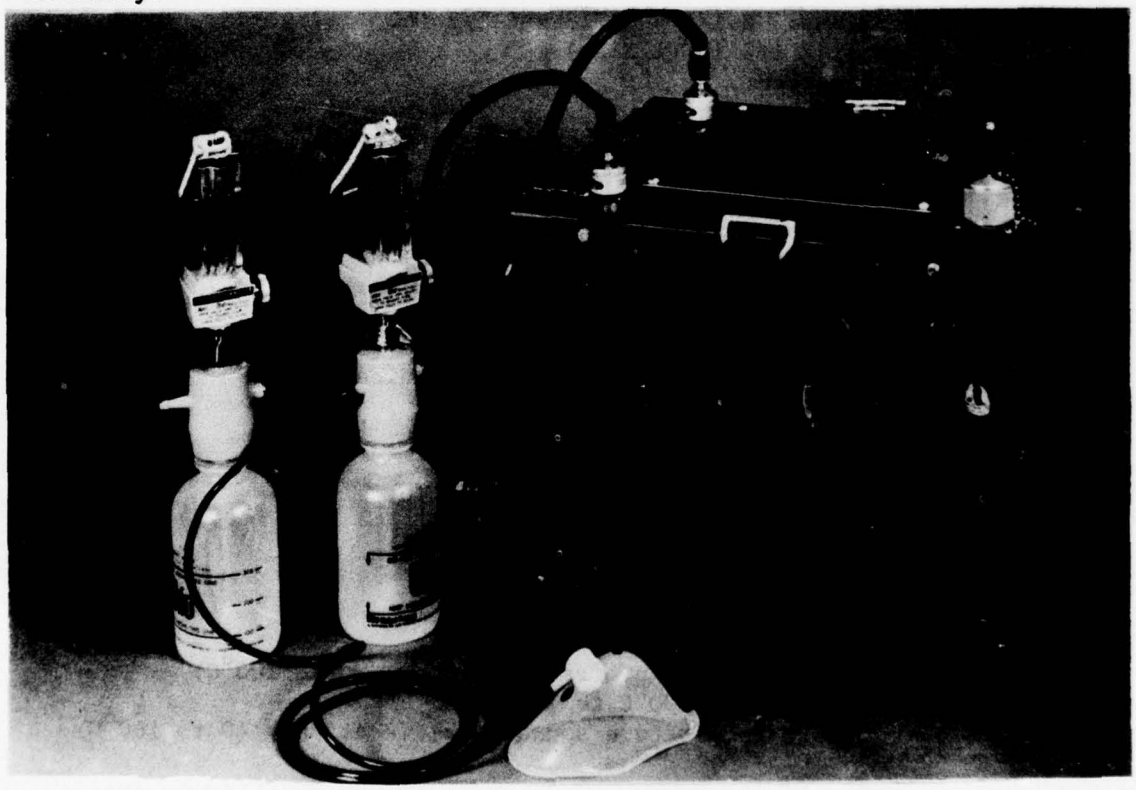
- Cockpit air flow (0 to 1000 fpm)
- Free air temp. (0 to 100°C)
- Black globe temp. (radiant temp.) (0 to 100°C)
- Dew point (-100°C to +60°C)
- Remote temperature sensors (11 locations) (0 to 100°C)

AEROMEDICAL EVACUATION SYSTEMS SUPPORT

This facility develops and/or tests and evaluates all patient care equipment used in the aeromedical evacuation system. If this facility approves the equipment, it may be used in the operational fleet. Every attempt is made to meet operational needs by approving commercially available equipment. If this fails, it develops equipment either in-house or on contract. Significant achievements in the development area are: Portable Therapeutic Liquid Oxygen System, Therapeutic Airborne Treatment Station, USAFSAM Multipurpose Suction Pump, C-141 Therapeutic-Oxygen Manifold, and Frequency Converter/Carrier (400 Hertz to 60 Hertz).

PORTABLE THERAPEUTIC LIQUID OXYGEN SYSTEM

Several types of multipurpose aircraft used in flying aeromedical airlift missions do not have integral therapeutic oxygen systems. When aeromedical evacuation patients are carried, oxygen is supplied by onloading small emergency bottles or large high pressure (2200 psi) cylinders. Using off-the-shelf components, a portable system was developed to eliminate this problem and a limited quantity was purchased for the inventory.



Portable Therapeutic Liquid Oxygen System

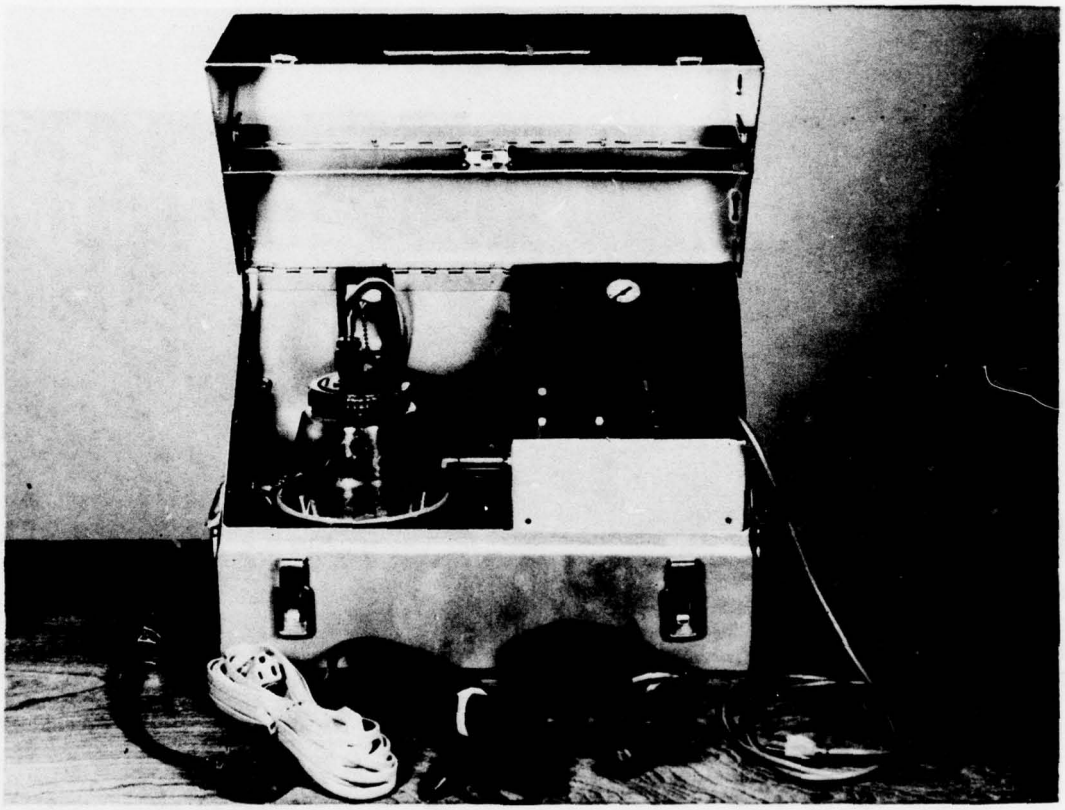
TRANSPORTABLE AIRBORNE THERAPEUTIC STATION (TATS)

In the past, medical materiel for patient care in the C-141 aircraft was transported in canvas bags, cardboard boxes, and metal chests, each of which had to be carried onboard the aircraft and tied down. Within the aircraft, there was no flat, lighted surface for the preparation of medications and reports. The TATS, which consists of two containers for storage of medical materiel essential for inflight patient care and management, corrects this problem. The units can be rolled onboard the aircraft and easily locked into the seat tracks in the area reserved for medical crewmembers.

Transportable Airborne Therapeutic Station (TATS)

USAFSAM MULTIPURPOSE SUCTION PUMP

A requirement exists for both continuous and intermittent vacuum for use with patients being transported onboard C-141 and C-130 aircraft configured for aeromedical evacuation. A prototype pump was developed in-house and successfully completed test and evaluation. Production quantities will now be purchased and entered into the operational inventory.



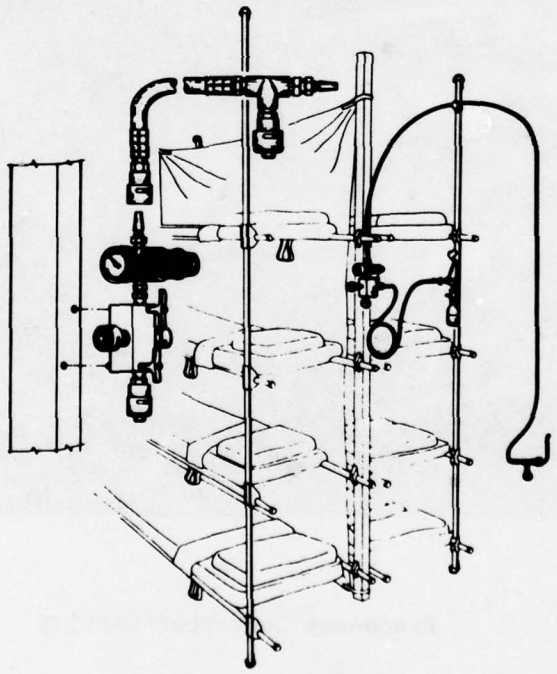
USAFSAM Multipurpose Suction Pump

C-141 THERAPEUTIC OXYGEN MANIFOLD DISTRIBUTION SYSTEM

The location of the C-141 aircraft therapeutic oxygen panel, right-forward bulkhead, requires 50 ft or more of low-pressure oxygen tubing to reach the litter patient positions. Reliability and control of flow are hampered by line pressure losses, flow splitting to accommodate more than one patient, and inadvertent crimping of the hose by aisle traffic and/or equipment.

The C-141 Therapeutic Oxygen Manifold Distribution System is a simple, three-outlet manifold, with a reduction valve set at 50 psi, which can be easily connected by hose to one of the aft recharger hoses on the aircraft LOX system. Each manifold enables aeromedical crews to administer metered quantities of oxygen, with proper individual patient control and humidification, to as many as three patients simultaneously at any location in the litter section. Three flowmeter and humidifier sets are included with each manifold. The capability to recharge portable walk-around oxygen bottles has been retained by including a recharger outlet in the system where it connects to the aircraft recharger system. A maximum of standard parts were used in the system.

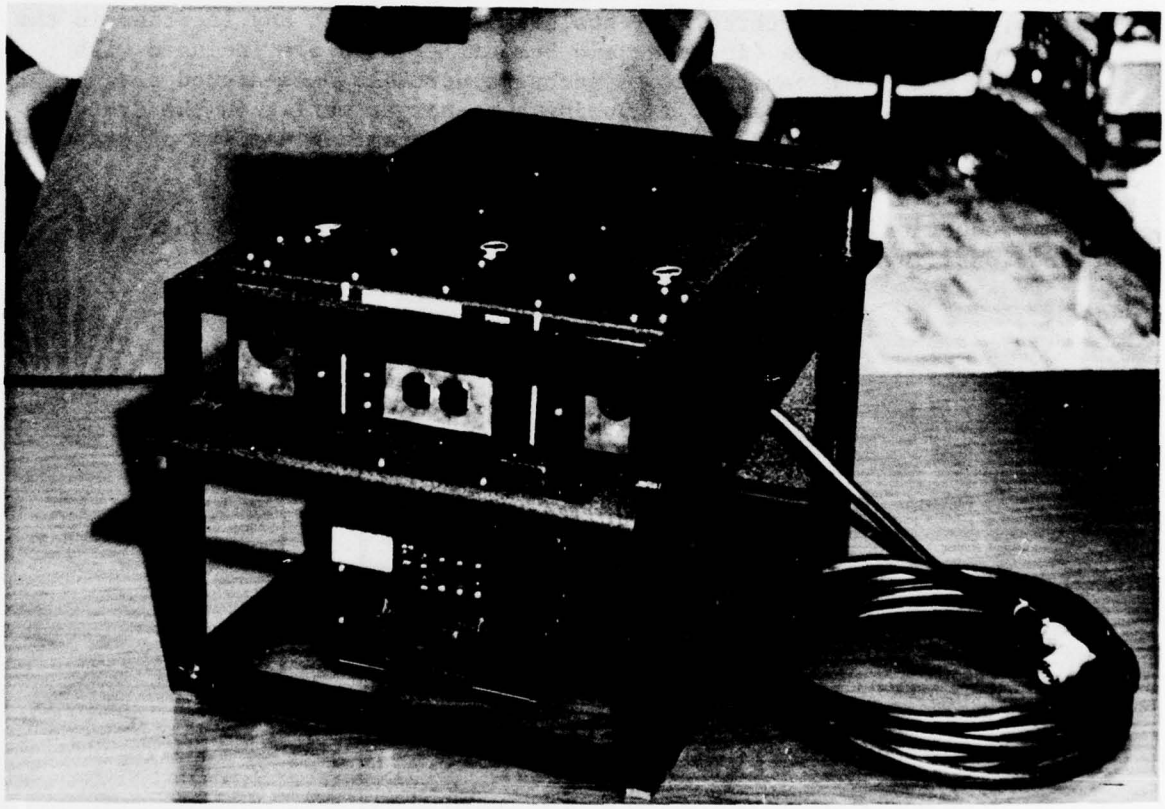
Production quantities will now be purchased and entered into the operational inventory.



Therapeutic-Oxygen Manifold Distribution System (enlargement seen on left side) with one flowmeter and humidifier set connected

FREQUENCY CONVERTER/CARRIER (400 to 60 HERTZ)

The C-141 and C-130 aircraft can supply only 28 volt DC or 115 volt AC 400 Hertz power to operate aeromedical evacuation equipment. This restriction increased the problems of providing low cost, efficient equipment for aeromedical evacuation flights. A converter/carrier assembly was developed to provide 115 volt 60 Hertz power. The assembly uses an off-the-shelf frequency converter in a special carrier. Production units have been delivered to Military Airlift Command.



Frequency Converter/Carrier

DATA SCIENCES DIVISION

The Data Sciences Division manages research and development on biotechnology for the acquisition, processing, interpretation, and retention of biological data. Major areas of activity include the development of mathematical models to predict or explain biologic/medical phenomena, development of statistical procedures required in USAFSAM operations, and guidance to biomedical scientists on the design of experiments and use of resulting data.

DISTRIBUTED PROCESSING SYSTEM

The Data Sciences Division is the single-point manager for the USAFSAM distributed computing system. The system places interactive terminals in the user laboratories, and "concentrator" minicomputers (e.g., PDP 11/34, 11/03) in each principal School R&D facility. The central processing unit is a PDP 11/70, which in turn is linked to the USAF San Antonio Data System Center IBM 360/65 and the USAFHRL UNIVAC 1108. User support is provided on equipment documentation, site preparation, and interfacing of laboratory equipment into the computer network.

CONSULTATION AND TRAINING

The Data Sciences Division provides consultative assistance to investigators in other Divisions on experimental design, use of the distributed computing system, interpretation of data, and allocation of computing resources. As the manager of biometrics training for the School, the Division has the capabilities of conducting on-call and periodic training in computer network use, computer languages, and statistical analysis. Information on available training, as well as new hardware and software resources, is provided in a monthly users' bulletin.

MATHEMATICAL CAPABILITIES

For efforts which exceed the capabilities of the laboratory user and/or his terminal system, the Division has the capability of providing professional assistance in either a support or coinvestigator role for such areas as mathematical modeling on- or off-line data repositories, advanced analytic procedures, and nonstandard, advanced computer programing.

FACILITIES AND EQUIPMENT

General Information

The data processing activities provide the researcher with complete data acquisition, conversion, and processing assistance. Analog or digital programmers, systems analysts, and data acquisition consultants are available to potential users for instruction on use of available hardware or to perform the total acquisition/processing task.

A variety of media commonly used for data storage may be accepted as input to the processing hardware. Analog and digital magnetic tape, punched paper tape, punched cards, and a limited variety of optically scannable score or test sheets can be accommodated. The facility also maintains a card (key) punch function.

To support data acquisition, portable analog magnetic tape recorders, analog computers, and data coupling devices for analytical instruments are available on a loan basis for short-term projects which could not normally justify the purchase of such equipment. It is sometimes possible to perform the complete processing job in the researchers' laboratory with use of portable analog computers.

Technical Information

Hardware

Principal equipment resources located in the Division are summarized as follows:

ANALOG:

EAI 680 Analog/Hybrid Computer
EAI 8880 Display Wing
EAI 8875 Eight Channel Oscillographs
MINIAC Analog Computers
TR-20 Analog Computers
PDP-12/20 A/D Conversion System with Analog Magnetic Tape Time Code and Tape Search Unit
PDP-12/40 with Analog & Digital Interfaces
Ampex FR-2000A Analog Magnetic Tape Systems
FR-2200 Analog Magnetic Tape System
FR-1300 Analog Magnetic Tape Systems
PDP-11/03 A/D Computer

DIGITAL:

WANG-2200
IBM System 3/10

IBM 1442 Reader/Punch
IBM 1403 Printer
IBM 5444 Disk Drive
IBM 3411 Tape Drive
Calcomp 765 and 930 Drum Plotters
Calcomp 910 Controller
IBM 360/65 (On-Line Shared Use) Located at USAF San Antonio Data Services Center (SADSC)
UNIVAC 1108 (On-Line Shared Use) Located at USAFHRL
PDP-11/70 CPU, 4-Level Automatic Priority Interrupt, hardware memory management, hardware multiply/divide, real-time clock 768K bytes parity core memory, 2K bytes/bipolar cache memory, hardware bootstrap loader, two 67MB disk drives, two 800/1600 BPI, 9-track 45 ips magnetic tape transports, floating point processor, 32-channel asynchronous multiplexor, three synchronous line interfaces, digital plot controller, line printer controller, and card reader controller

Other Equipment

PUNCHED CARD EQUIPMENT:

Univac 1710
029 Keypunch
059 Verifiers
514 Reproducer
083 Sorter

OPTICAL SCANNER:

OPSCAN 17 Optical Mark Reader

Languages

IBM 360/65
ANS COBOL Version 2
ANS COBOL Version 4
FORTRAN IV G, H, AND B1
PL/1
Basic Assembly Language (BAL)
Report Program Generator (RPG)
WATFIVE FORTRAN IV

DEC PDP-8, PDP-12
FORTRAN IV
FORTRAN II
BASIC
FOCAL
PAL8 Assembly Language

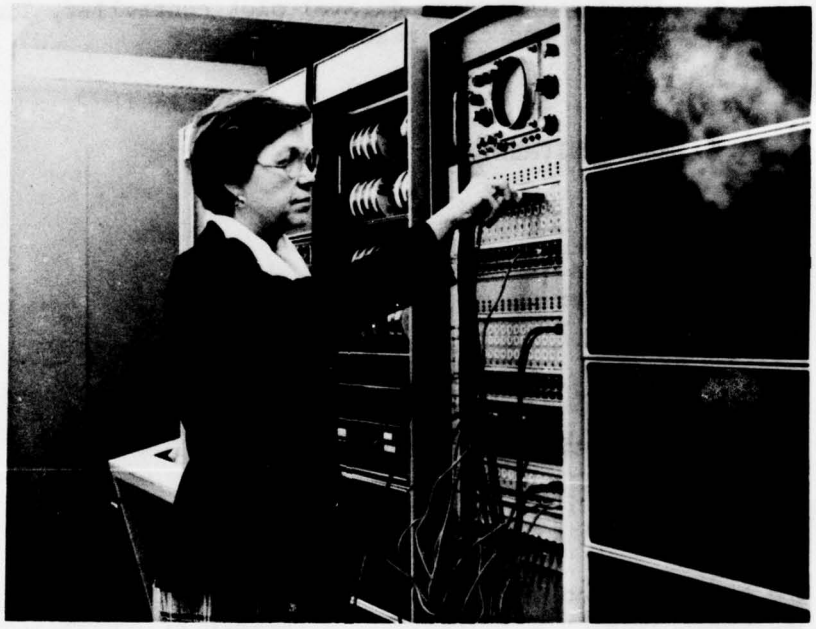
DEC PDP-11
FORTRAN IV Plus
BASIC Plus 2

Utilities

IBM 360/65
SORT/MERGE
OS Utility Programs

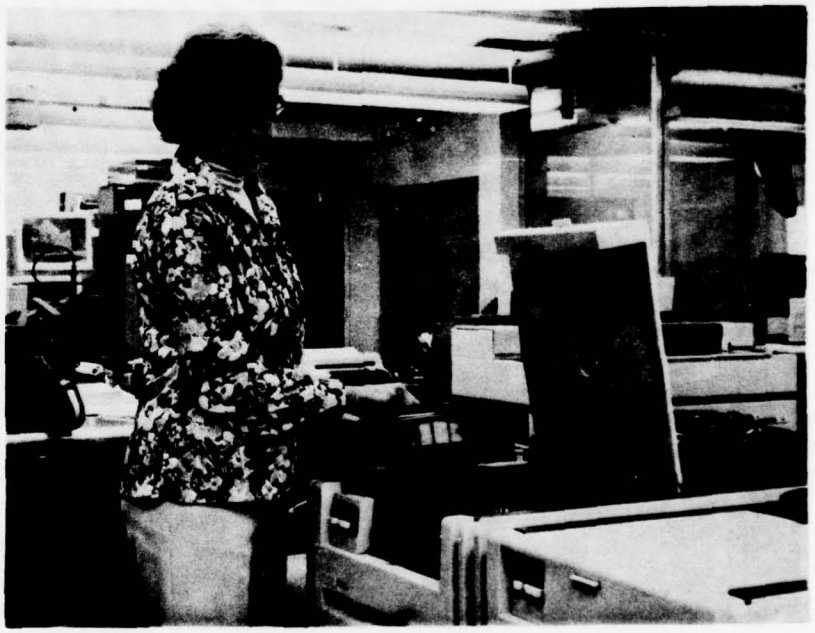
DEC PDP-8, PDP-12
OS/8 Utility Programs
DIAL Utility Programs

DEC PDP-11
RT 11 Utility Programs
RSX 11 Utility Programs
SAMSTAT
BMDP



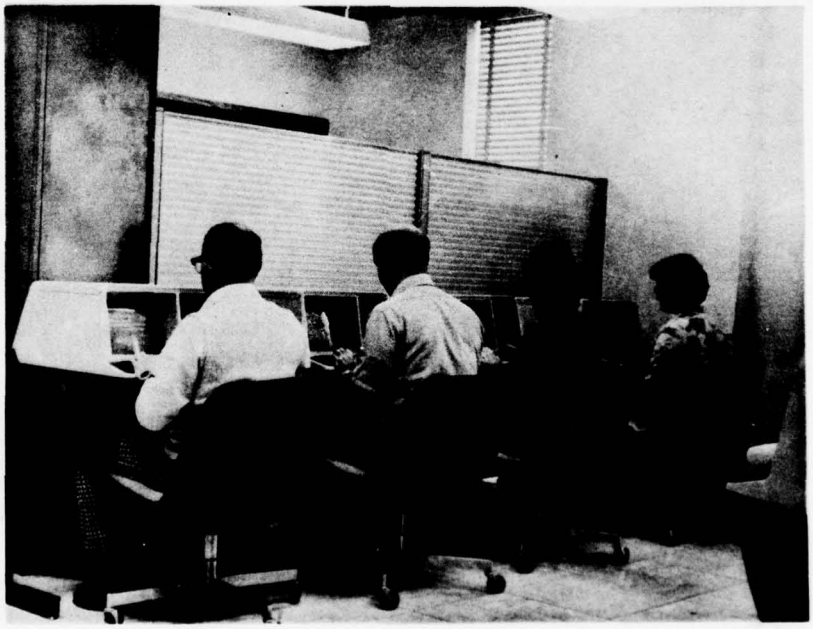
Communications Line Patching Between Host
Computer and Remote Terminals

Computer Operator Responds to Request for
Mounting Magnetic Tape on Host Computer



Installing Removable Magnetic Disk Pack
on Host Computer Drive

Use of Printing Type Alphanumeric Terminal



Network Users' Training Course Includes Hands-on Use of Video Terminals

EDUCATION DIVISION

The Division provides education and training for officer and enlisted medical service personnel who are in direct support of the Air Force flying and missile missions in 21 enlisted and 29 officer courses. The academic disciplines include aerospace medicine, preventive medicine, occupational medicine, veterinary medicine, bioenvironmental engineering, flight nursing, and aerospace physiology. Headquarters, USAF, prescribes the courses through the USAF MED-ED Plan and other programming documents. The Division has technical and subject matter experts to prepare draft manuscripts of training materials, technical manuals, and pamphlets; they also design, develop, and implement education programs. The teaching staff is supplemented by personnel from within the USAF School of Aerospace Medicine research and development functions, clinical medicine staff, as well as consultants from the national scientific community.

General Information

Advanced officer education is offered in residency programs: Aerospace Medicine, Occupational Medicine, Preventive Medicine, and Environmental Health Nursing. Officer lateral education encompasses: Aerospace Medicine, Bioenvironmental Engineering, Veterinary Medicine, Physiological Training, and Flight Nursing. Continuing education courses are: Global Medicine, Medical Aspects of Advanced Warfare, Operational Aeromedical Problems, Operational Problems in Aerospace Physiology, Compression Chamber Team Training, Compression Therapy, Operational Aeromedical Nursing, Current Veterinary Service Problems and Programs, Operational Laboratory Animal Medical Problems, Medical Disaster Preparedness Operations, Laser Hazard Assessment, Bioenvironmental Engineering Symposium, Environmental Protection, Industrial Radiological Hazards, Industrial Hygiene Measurements, Behavioral Sciences Symposium, Medical Food Service Management for Dietitians, Optometry Seminar, and Preventive Dentistry. Two courses are provided for allied officers: Advanced Aerospace Medicine, and Aerospace Physiology for Allied Medical Officers. Airman courses at the technical level are in: Aerospace Physiology, Aeromedical Evacuation, Animal Technician Advanced, Medical Aspects of Food Handling, Veterinary Statistical Procedures, Environmental Protection, Industrial Radiological Hazards, Industrial Hygiene Measurements, Radiation Health Technician, Medical Chemical Defense Training NCO, and Ophthalmology Surgical Technician. The basic courses include: Aeromedical Specialist, Aerospace Physiology Specialist, Veterinary Specialist, Animal Technician Basic, and Environmental Health Specialist. Approximately 2632 officers and 1459 airmen and 80 civilians from the continental United States and overseas commands now graduate each year. The foreign student enrollment is approximately 125 annually, representing many allied countries.

The Division provides management and administrative functions involving educational methodology, programming and scheduling education activities, curriculum development, student counseling, and instructor education.

Specialty Training Standards and Course Training Standards are written for aerospace medicine, preventive medicine, veterinary medicine, flight nursing, and aerospace physiology.

The Division maintains the Air Force Toxicological Exposure Data Repository and the Aerospace Medicine Report Repository. These resources provide valuable information for educational purposes and research reference.

Technical Information

Hypobaric chambers for altitude indoctrination

Swing landing trainer for parachute training

Ejection trainer for aircrew member refresher training

Ejection trainer with tower for egress training

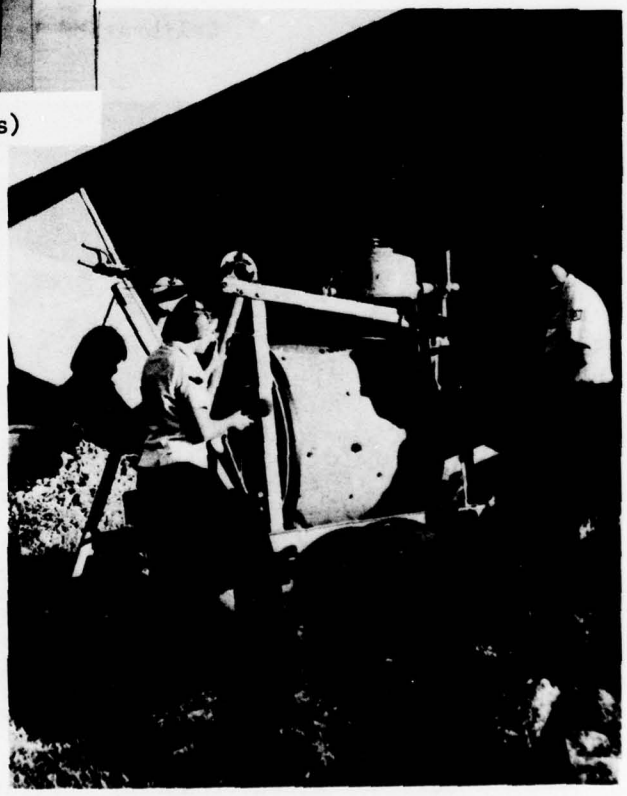
Hyperbaric chamber to provide training for selected personnel and to treat emergency patients.

Barany chair and vertigon trainer for spatial disorientation training

C-54, C-9, C-141 aircraft mock-ups provide training for the care and treatment of patients in flight

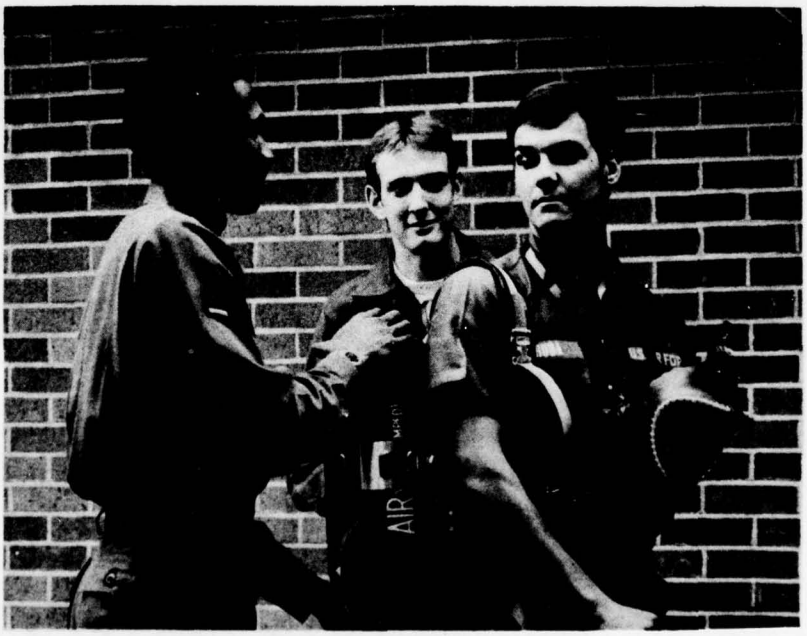
C-54 aircraft mock-up and ditching tank with current survival equipment for survival training

Water Analysis (Stream Surveys)



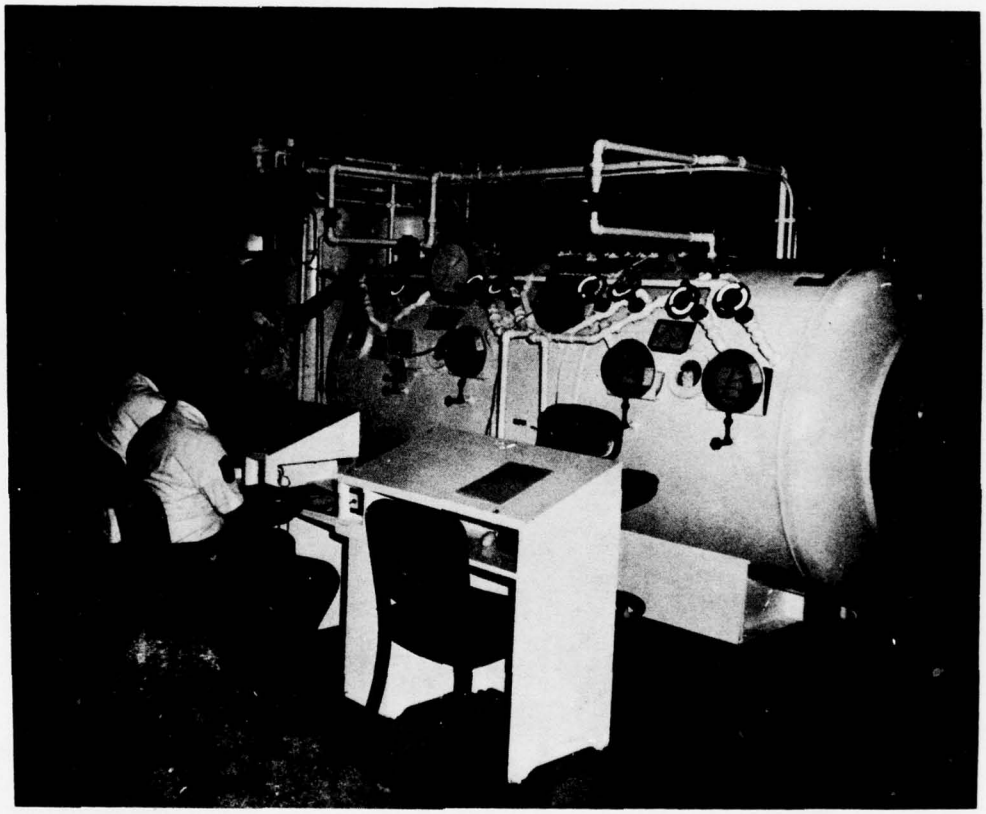
Noise Survey (Impulse/Impact)

Calibration Laboratory

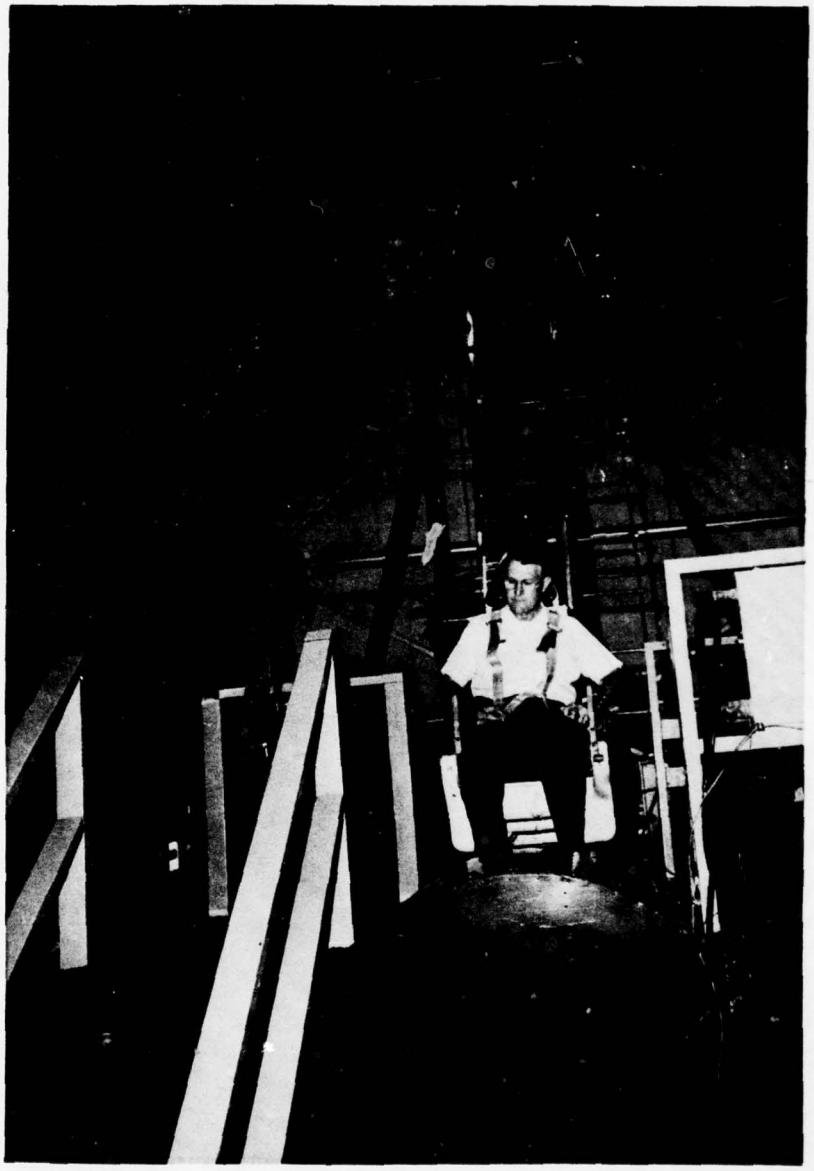


Self-Contained Breathing Apparatus Laboratory Training

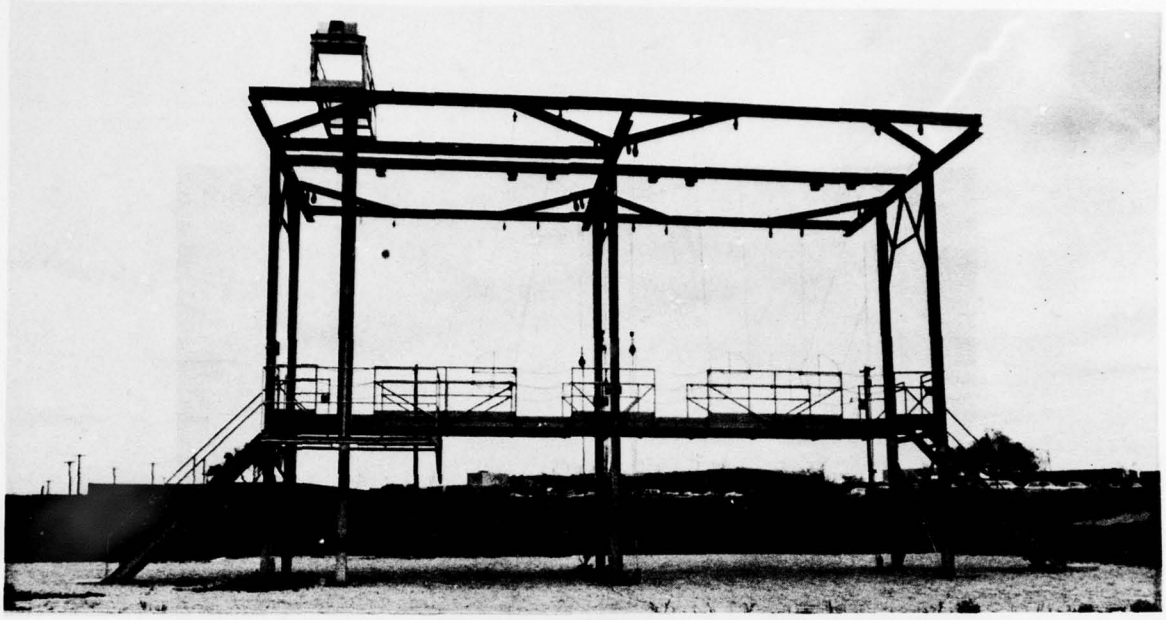
Hypobaric Chamber



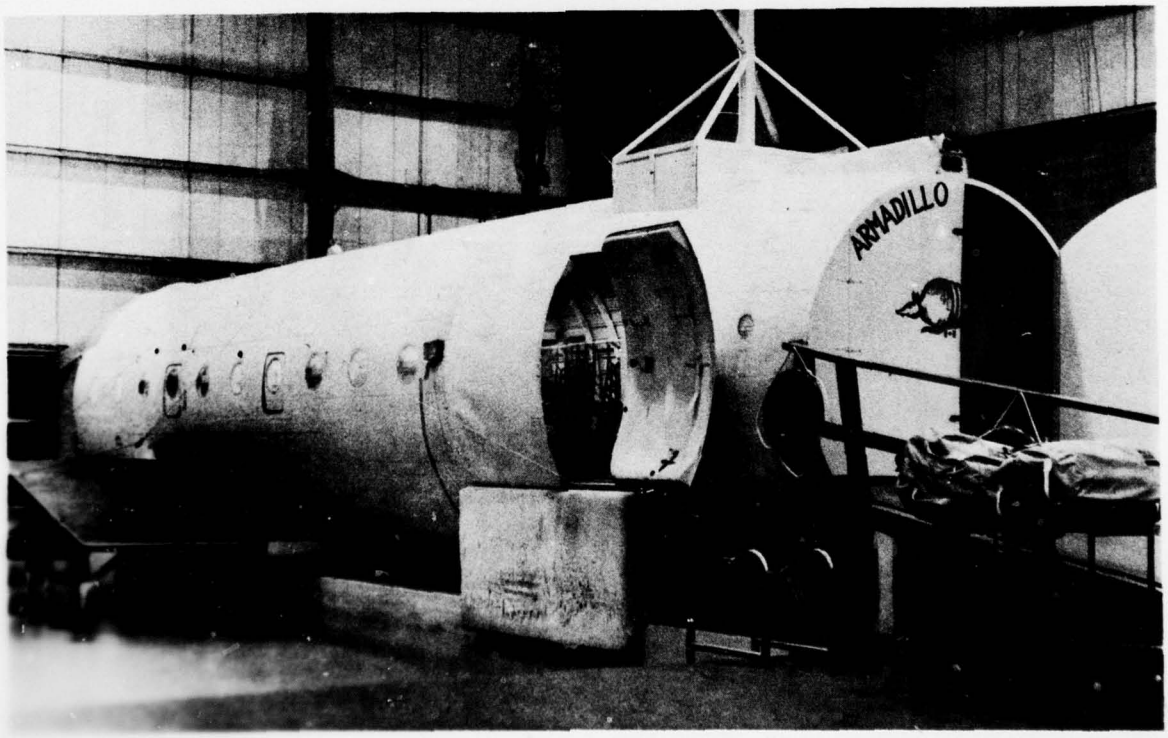
Hyperbaric Chamber



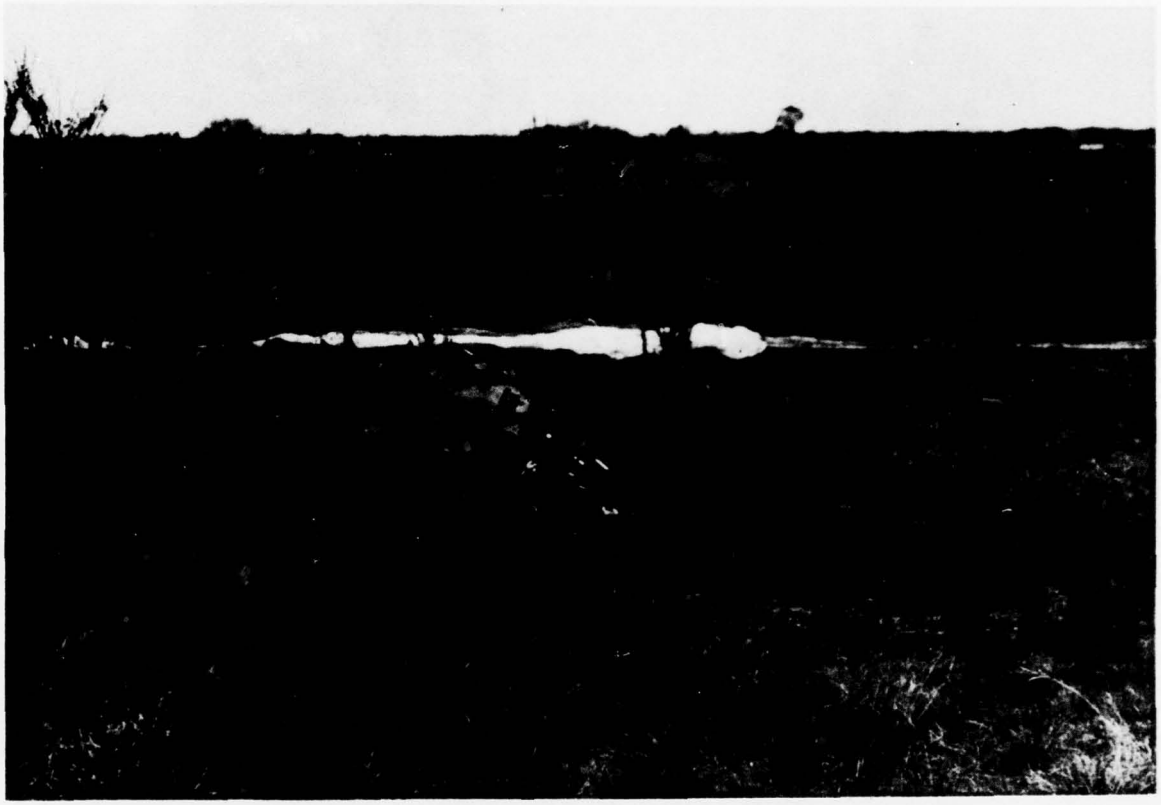
Ejection Seat Trainer



PLT/SLT Training Area

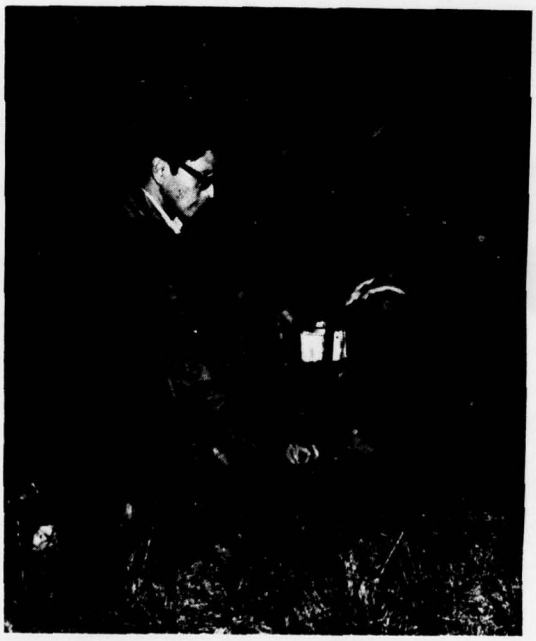


Ditching Tank with C-54

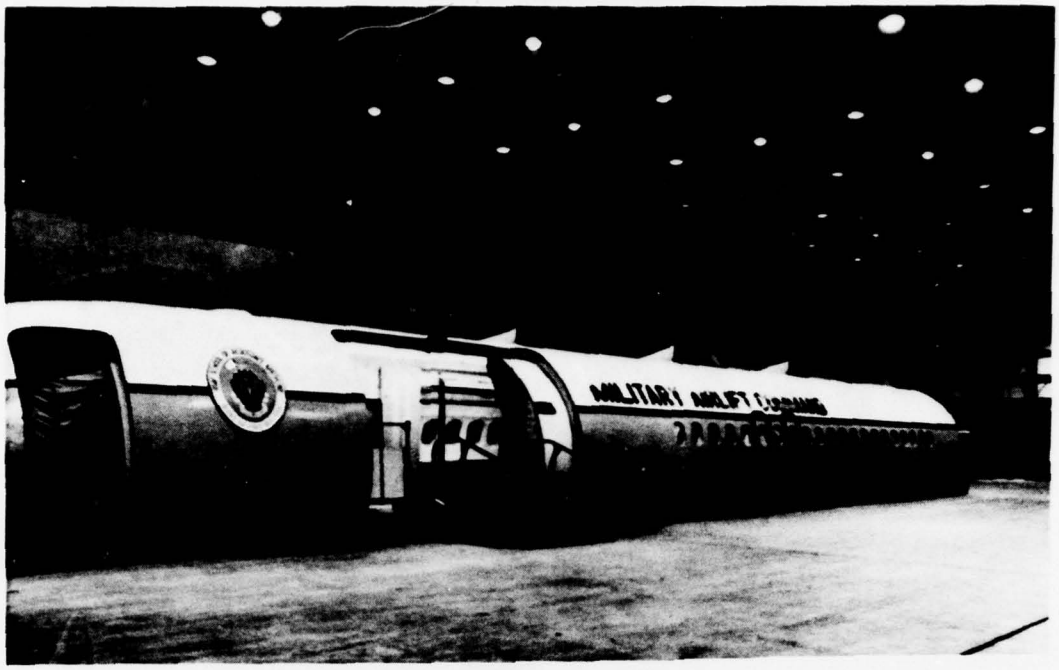


Aircraft Accident Scene

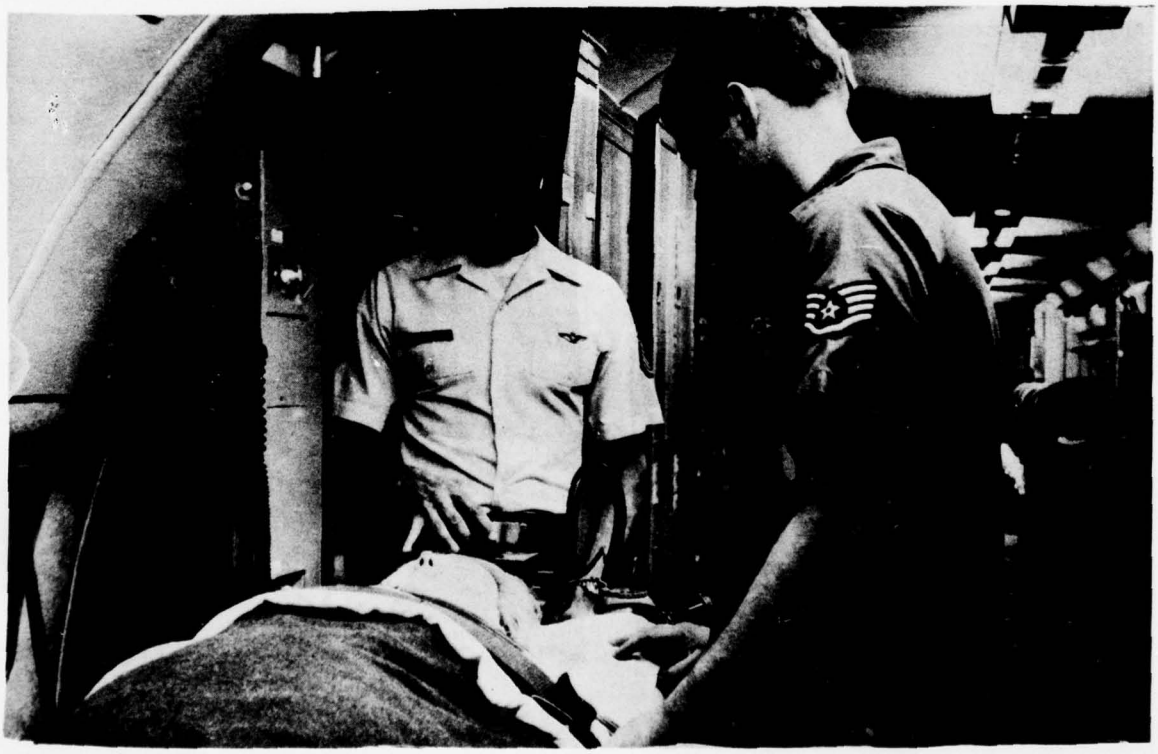
Bárány Chair



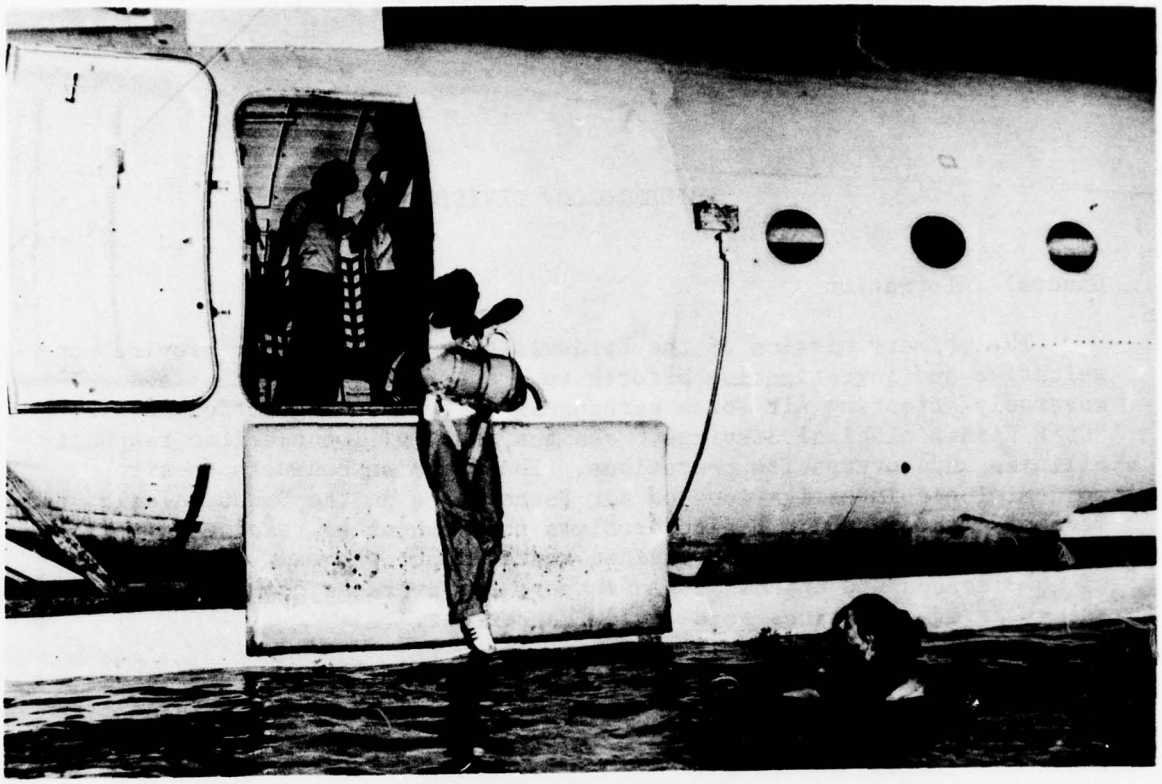
Disaster Training



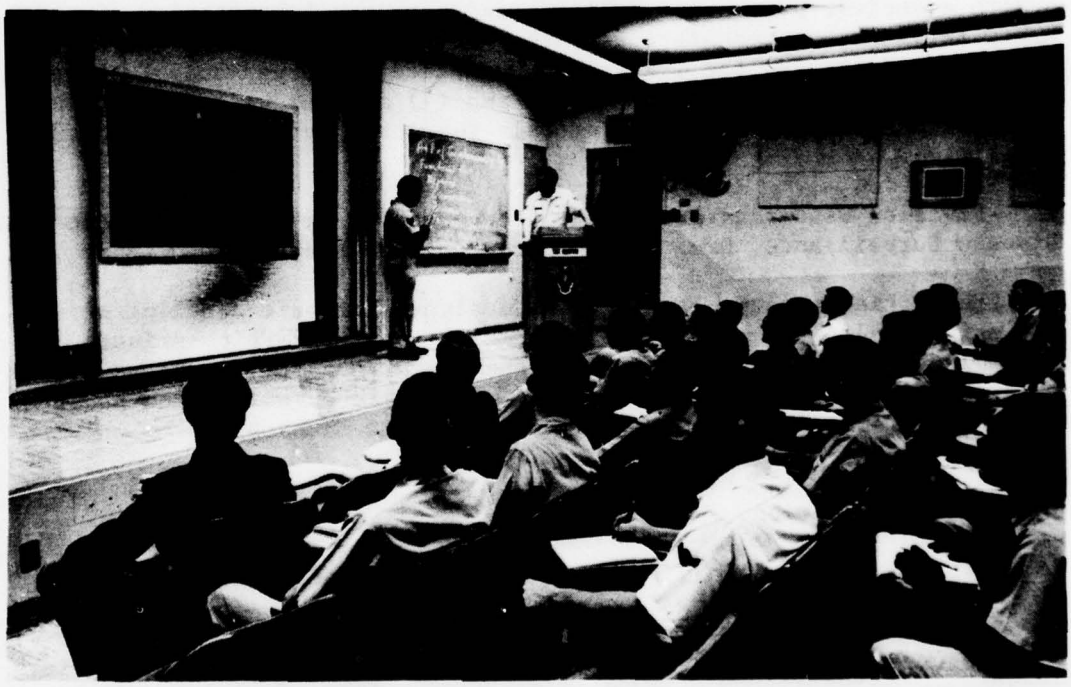
Exterior of C-9 Trainer



Aeromedical Technician Instruction in C-9 Trainer



Water Survival Training



Classroom in Academic Building

EPIDEMIOLOGY DIVISION

General Information

The primary mission of the Epidemiology Division is to provide consultative and investigative efforts to prevent or control diseases adversely affecting Air Force personnel. Air Force Regulation 161-12, "USAF Epidemiological Services," assigns the Division specific responsibilities and governs its operations. The Division conducts on-site epidemiologic investigations on Air Force bases in the CONUS, Alaska, and Panama of those public health problems that cannot be resolved with local resources. In addition, it provides surveillance programs for key infectious diseases and epidemiologic support for overseas commands, increasing the scope of operations to a worldwide concept.

Additional related missions include (1) provision of reference laboratory and consultant services in clinical laboratory medicine for USAF medical facilities, (2) laboratory analysis and support for a 14-state area in the Triservice Drug Abuse Counteroffensive (under DOD Instruction 1010.1) to include prevalence and incidence studies of new and abused drugs, (3) liaison with national and international public health agencies, preventive medicine and research laboratories of the other services, representation of the Air Force at the Armed Forces Epidemiologic Board, the Triservice Committee for Drug Abuse Testing, and the Armed Forces Pest Control Board, and (4) monitoring and approving requisitions of diagnostic biologicals submitted by Air Force medical facilities.

Division resources are divided functionally as follows: Biochemistry, Disease Surveillance, Drug Abuse Detection, and Microbiology.

Facilities include laboratories designed for safe handling of biologic samples and chemicals in three major areas: Biochemistry, Entomology, and Microbiology. Comprehensive laboratory services are offered in the areas of bacteriology, clinical chemistry, drug abuse detection, forensic toxicology, immunology, and virology.

Technical Information

Laboratories equipped for work with highly infectious agents and biologic toxins

Laboratories and animal rooms for complete identification of microorganisms

Radioimmunoassay screening laboratory and adjacent confirmatory laboratory for testing urine specimens for drugs of abuse

Laboratories for radioassay studies and for forensic toxicology

Laboratories for automated and semiautomated production of difficult clinical biochemistry tests

Laboratories and insectaries for arthropod studies and pesticide testing

Automated pipetting stations and gamma counters for radioimmunoassay analysis

Class II laminar flow biological safety cabinets and laminar flow clean bench

Phase contrast, fluorescent, and light microscopes with photomicroscopy capability and other optical equipment for microbial study

Continuous fermentation devices and specialized incubators

Atomic absorption, ultraviolet, infrared, and visible light spectrophotometers

Spectrofluorometers

Gas chromatographs

Liquid scintillation counters and other radioisotope instrumentation

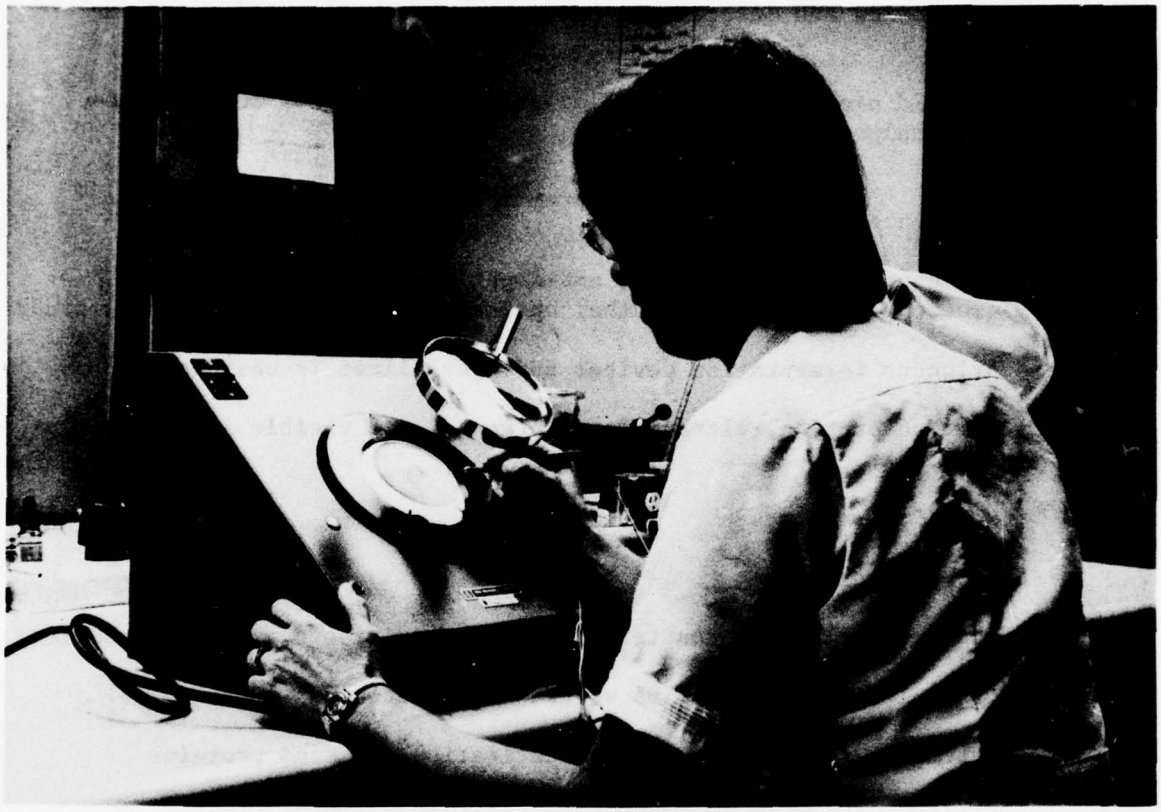
Stock culture collection of viruses and bacteria

Instruments for nephalometric quantitation of serum proteins

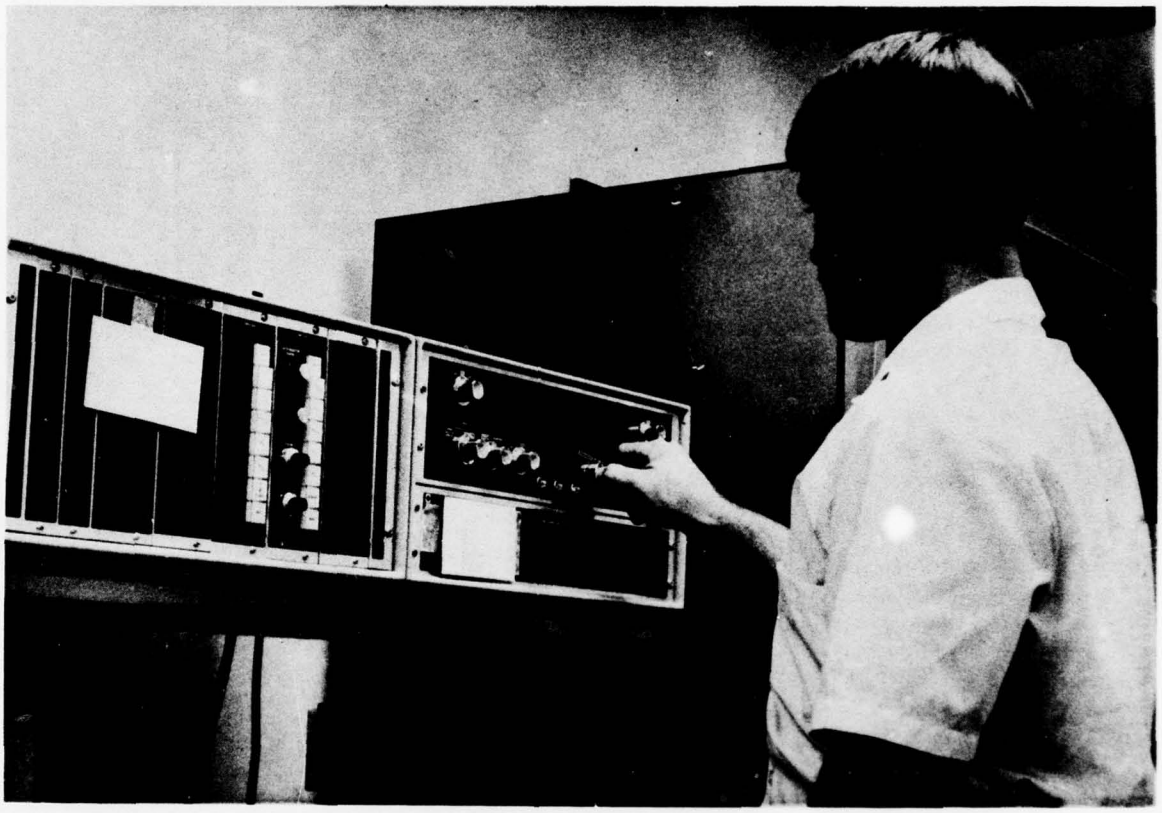
Autotiter equipment for serologic testing

Cryostat processing of tissues

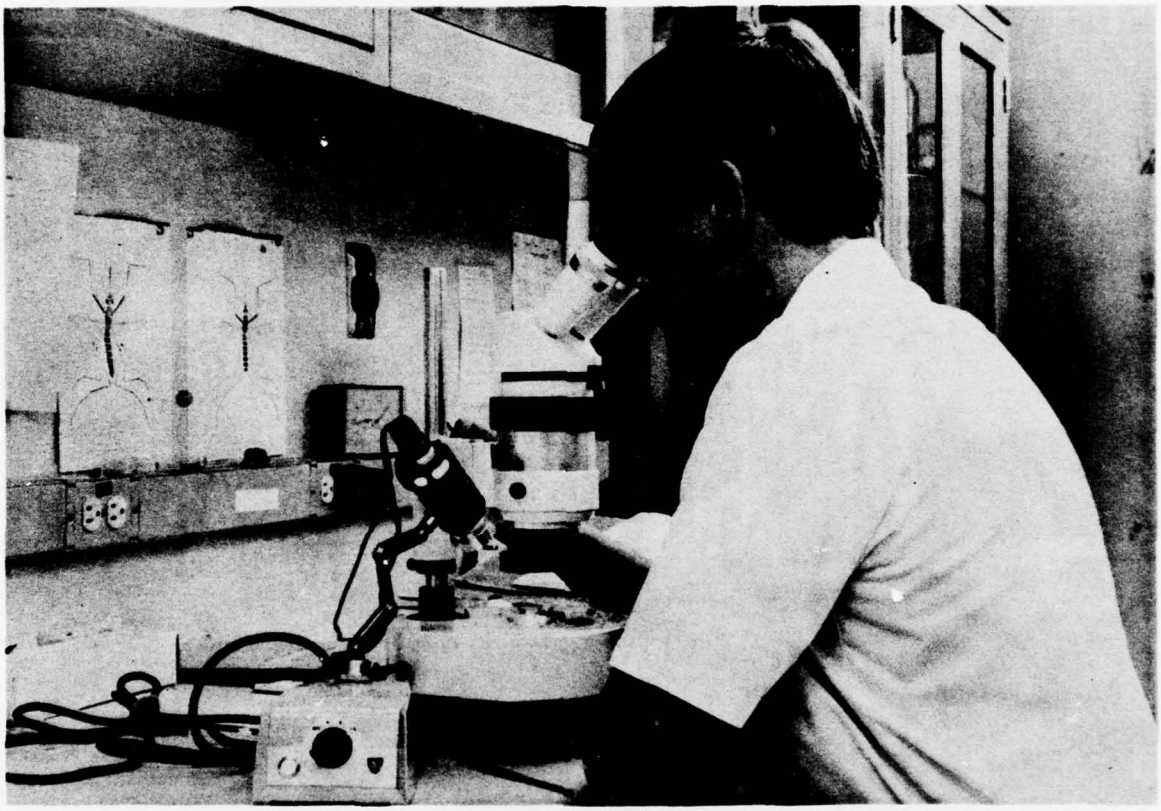
Lyophilization apparatus for preservation of biologic materials



Bacterial Counter



Radioimmunoassay



Entomology Laboratory
(Identifying Mosquitoes)

Gas Chromatograph

HYPERBARIC MEDICINE DIVISION

The Hyperbaric Medicine Division is designated as the USAF Hyperbaric Center. The Division is responsible for using the existing hyperbaric chambers to establish clinical indications for hyperbaric oxygenation (HBO) and determine clinical and cost effectiveness of HBO for USAF hospitals. This Division also determines future staffing requirements and provides authoritative guidance for the U.S. Air Force in HBO applications and patient management.

General Information

The Hyperbaric Medicine Division has two chambers available for treatment protocols. The Division maintains treatment and consultation capability 24 hours per day, 7 days per week. The Division is charged with the responsibility of establishing the full capability for therapy, education, and consultation in hyperbaric medicine. The Division functions as a prototype to determine whether clinical hyperbaric chambers should be located in regional USAF hospitals and, if so, what facilities and manpower are needed.

Hyperbaric oxygenation is achieved by having patients breathe 100% oxygen by mask while exposed to elevated barometric pressure in a compressed air diving chamber. After the hemoglobin is fully saturated, additional oxygen is carried to the tissue in physical solution in the plasma. Oxygen content at any point in tissue is dependent on the distance of the tissue from functioning capillaries, the oxygen demand of the tissue, and the oxygen tension in the capillary. HBO works by elevating this oxygen tension, thus getting oxygen to those areas that were not being oxygenated before.

In the case of decompression sickness and gas embolism, not only is the nitrogen eliminated by the increased oxygen tension, but the increased pressure on existing nitrogen bubbles forces them back into solution. HBO for carbon monoxide poisoning provides the body with oxygen via the plasma and rapidly eliminates carbon monoxide from the system. Finally, gas gangrene can be treated successfully as the organism involved will not produce toxin in an elevated oxygen environment. This HBO treatment is combined with proper surgical procedures and antibiotics.

Treatment protocols and clinical trials are conducted in the applications of hyperbaric medicine for osteomyelitis, radionecrosis, chronic non-healing wounds, and other anerobic infections, such as severe systemic mycosis. These programs are conducted in addition to treatment of gas gangrene, decompression sickness, cerebral air embolism, and carbon monoxide poisoning.

The Division cooperates fully with and provides full hyperbaric medicine coverage for the Wilford Hall USAF Medical Center, the Audie Murphy Veterans Administration Hospital at San Antonio, The University of Texas at San Antonio Medical School, and Brooke Army Medical Center.

A part of this effort includes training in hyperbaric medicine for the house staff of these institutions. A part of the consultation service is to maintain current status reports on all chambers so that patients can be referred to the nearest civilian or military chamber with the capability to treat the specific disorder in question.

Technical Information

The Hyperbaric Facility is comprised of two hyperbaric chambers, two low pressure compressors, three breathing gas systems, two compressed air storage systems, and a central operating console.

The treatment chambers are cylindrical steel structures divided into two areas, a main compartment and lock compartment. Both compartments are single entry, closed by steel doors. Windows and closed circuit television monitors are provided on each side to insure adequate observation of inside personnel and patients.

Oxygen is supplied to the chambers from a central liquid oxygen supply. An emergency backup system is provided if a malfunction occurs in the central system.

Dimensions	CHAMBER I	CHAMBER II
Overall length (ft):	25	14.7
Overall width (ft):	13	6.5
Overall height (ft):	14	7.5
Volume		
Lock compartment (ft^3):	800	147
Chamber compartment (ft^3):	800	273
Operating pressure (psi):	100	100
Maximum test pressure (psi):	150	150

AD-A072 881 SCHOOL OF AEROSPACE MEDICINE BROOKS AFB TX F/G 6/5
FACILITIES AND CAPABILITIES OF THE UNITED STATES AIR FORCE SCHO--ETC(U)
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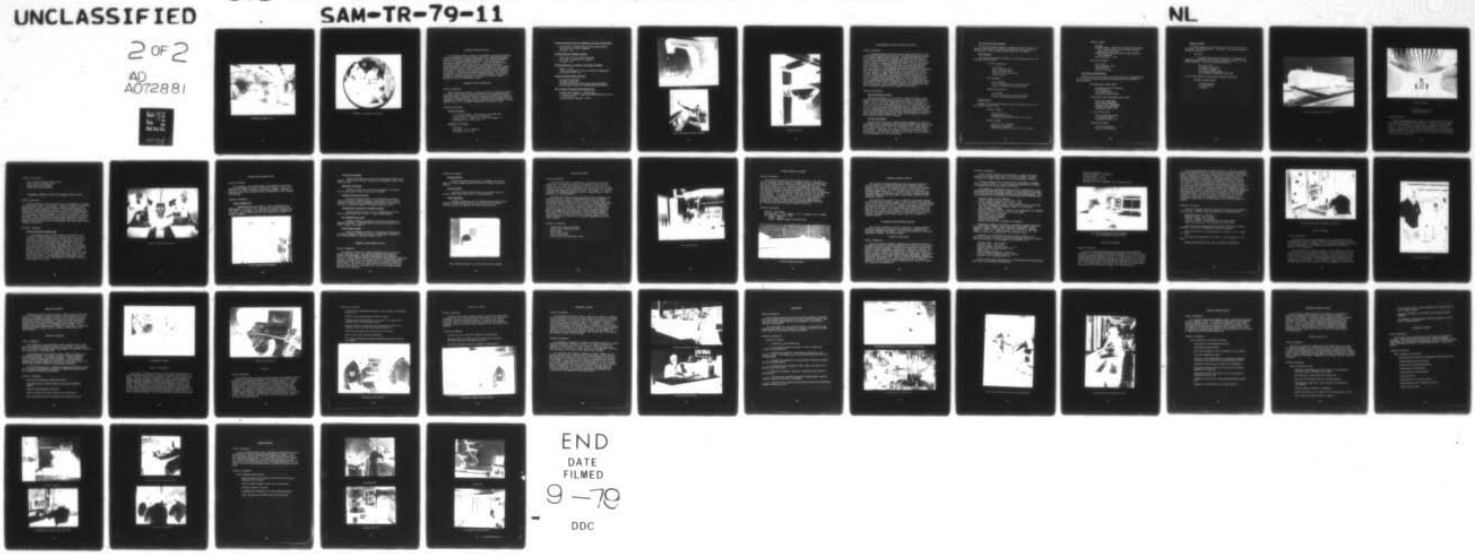

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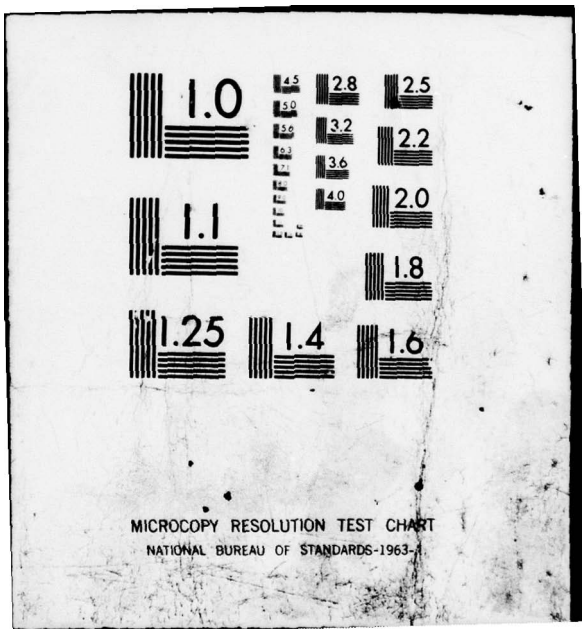
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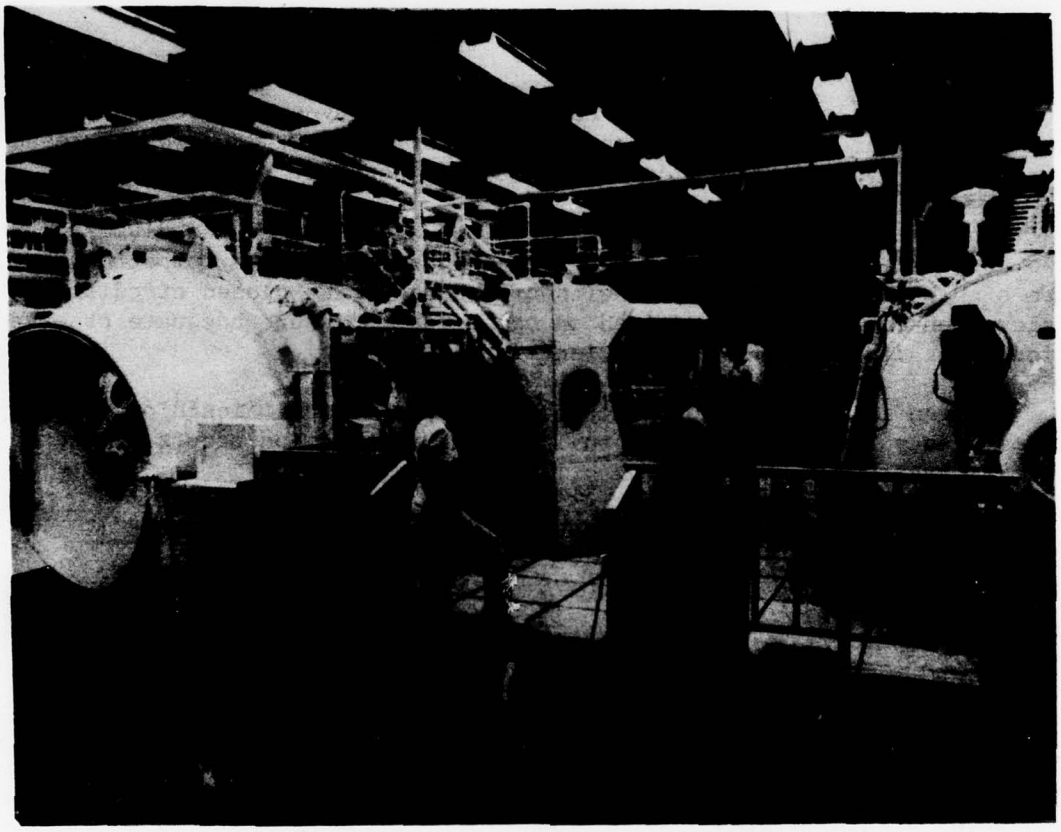
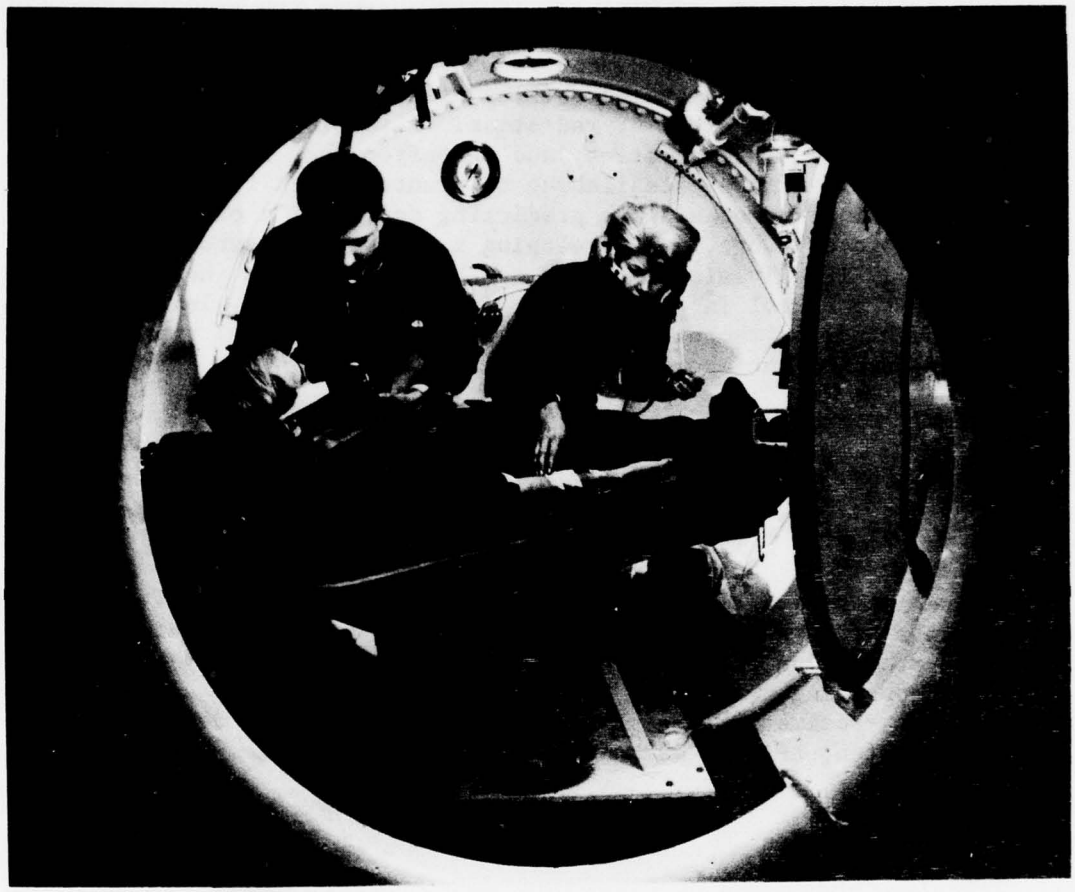


Hyperbaric Chamber Area



Preparing for Hyperbaric Exposure

RADIATION SCIENCES DIVISION

The Radiation Sciences Division is responsible for research relating to the electromagnetic and particulate spectrum of radiations and their effects on man in the aerospace environment. The Division establishes criteria for assessing the vulnerability of Air Force personnel to operational stresses created by radiation. These include the effects of nuclear weapons, laser systems, and radiofrequency radiation. Responsibilities include establishing tolerance limits for such stresses either in combination or singly, predicting degradation of performance with respect to exposure, and developing a protective posture (physical or biologic). The Division provides teaching support to the education programs of the School in the areas of radiation physics, laser safety, and isotope handling techniques, and research and clinical support through the use of the whole body counter.

RADIATION SCIENCE LABORATORIES

General Information

These laboratories provide a composite facility for radiation research. They house a wide range of radiation sources in large shielded exposure rooms and provide an extensive physical dosimetry capability and laboratory space for operating personnel, biologic experimenters, and animal care and maintenance. Dosimetry systems and techniques have been developed to measure electron, proton, x-, and gamma radiation with accuracies of $\pm$3%.

Technical Information

Linear Accelerator

3 to 6 Mev electrons: Dose rates up to 500,000 R/min
6 mvp x-rays: Dose rates up to 300 R/min
Exposure volume: Length, 9 m; width, 6 m; height, 3 m
Field size at 1 m: 30 x 25 cm

AN/UMD-1A ^{137}Cs Source

100 curies
Dose rate: 0.03 to 1000 R/hr
Calibrated by NBS: $\pm$2%

Varian Associates Electron Paramagnetic Resonance Spectrometer

Reads neutron and gamma dose utilizing alpha alanine
Dose range: 50 rad to 5 megarad
Accuracy: ±3%

Thermoluminescent Dosimetry Systems

Reads dose from any ionizing radiation
Dose range: 1 millirad to 1 megarad
Accuracy: ±2%

Tissue-Equivalent Ion Chambers (Secondary Standards)

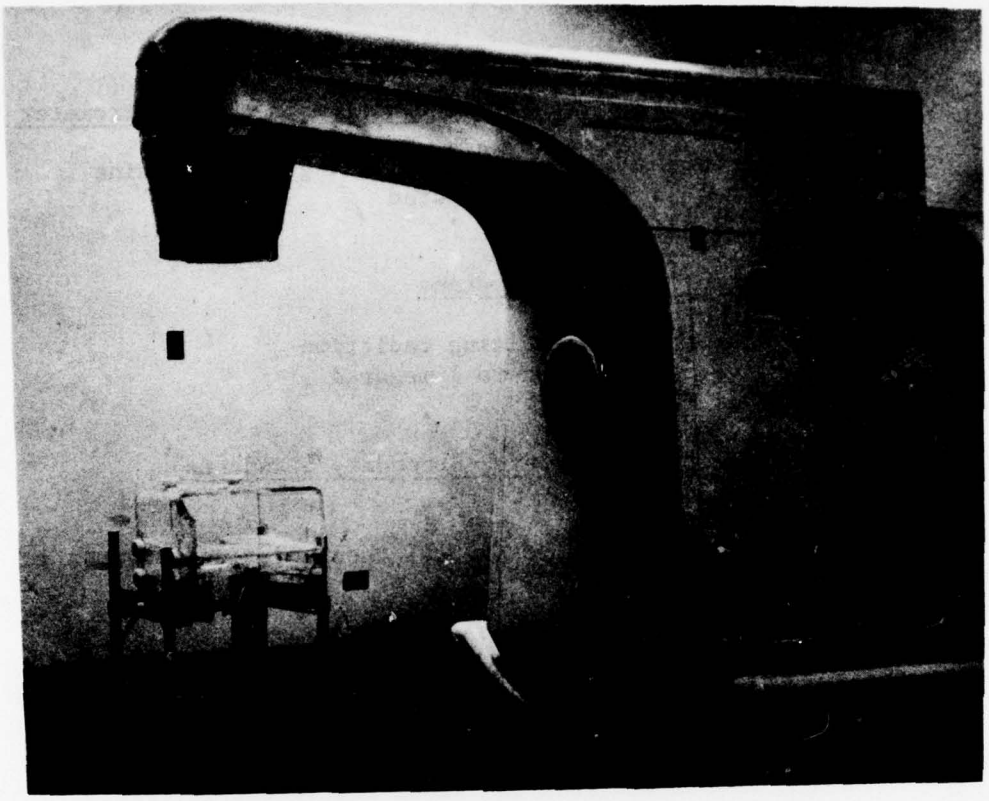
Volume: 1 cm^3
From 1 milliroentgen to several thousand roentgens/min
Calibrated by NBS: ±2%

Tissue-Equivalent Rhesus Phantoms

Two neutron equivalent
Two gamma equivalent
Multiple cavities for making depth dose measurements
Actual rhesus skeleton in tissue-equivalent materials

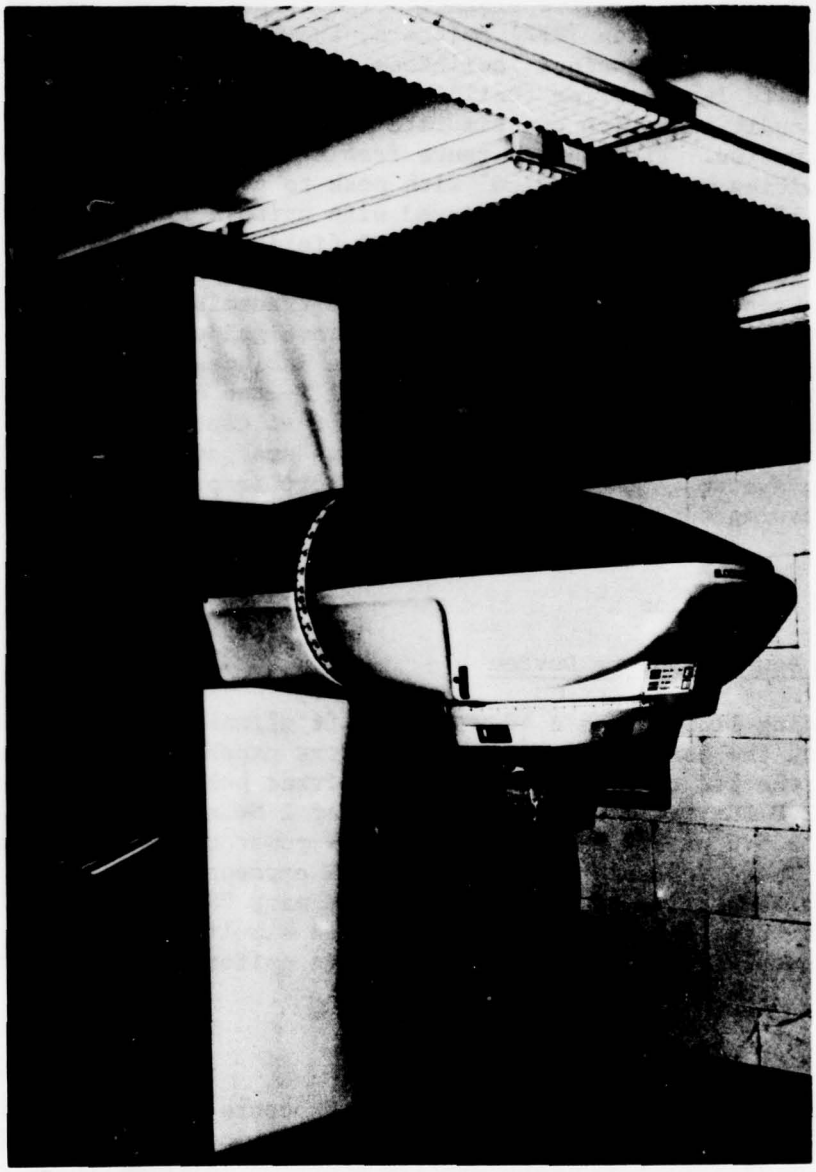
AECL Eldorado 78 Cobalt-60 Teletherapy Unit

Maximum source capacity: 10,000 curies
Dose rate at 1 meter: Approx 150 R/min with field size of 40 cm x 40 cm
Maximum exposure distance: 550 cm



Linear Accelerator

Linear Accelerator Control Console



Cobalt-60 Source

RADIOFREQUENCY RADIATION EFFECTS FACILITIES

General Information

To investigate specific biologic effects associated with Air Force radiofrequency radiation (RFR) emitters, the Radiation Sciences Division has developed several unique facilities. These facilities, housed in three separate laboratories (Buildings 1185, 1187, and 175E), provide exposure conditions which can simulate essentially any Air Force operational situation. Frequencies range from 4 MHz to 10 GHz, and average power densities up to 200 mW/cm^2 with peak to average power density ratios of 10,000 to 1 can be achieved with uniform field geometries. Many combinations of pulse-modulated RFR fields in addition to continuous wave (CW) fields can be produced in each of three climate-controlled anechoic chambers, a large volume TEM mode transmission line, a series of small TEM mode chambers, and circular wave guide exposure cells. Specific and requisite RFR instrumentation includes a variety of state-of-the-art power density monitors, special E- and H-field monitoring probes, implantable noninterfering probes that can be effectively used in the presence of RFR fields, calorimeter systems, and differential power monitoring systems. On-line computer support is provided for real time data processing throughout each of these RFR laboratories.

Technical Information

Peak Power Exposure Device

Building 1185 houses a 40 x 20 x 10 ft climate-controlled anechoic chamber and the associated source generators capable of producing RFR fields in the 1.2 to 2.4 GHz range with either pulsed or CW powers up to 20 kW; a 2.8 GHz field with a peak power of 2 MW and average power of 2 kW; and a 5.6 or 9.4 GHz field with peak power of 1 MW and average power of 1 kW. These generators can produce RFR exposure conditions which are indeed representative of those produced by many USAF operational radars. Any two of these generators can be operated simultaneously, to investigate mixed frequency tissue interactions. Large uniform fields are produced making multiple animal exposures possible.

Circular Wave Guides

Twenty circular wave guide (rodent) exposure chambers are available in Building 175E, in association with regular biochemical type laboratories. Uniform RFR fields of 2450 MHz RFR are provided in 10 of these chambers and 10 serve as controls. They, too, can provide CW or pulsed fields up to 100 mW/cm^2. Each chamber is complete with RFR noninterfering cages, water bottles, and feed tubes, and they are sufficient to house animals in an RFR environment for up to 23 hours/day.

VHF and UHF TEM Mode Chambers

Two TEM mode chambers capable of operating in both pulsed and CW mode at frequencies up to 250 MHz and 500 MHz are also available in Building 175E. These chambers provide fields up to 60 mW/cm^2.

RFR Generators

The principal generators available in the RFR Laboratory have the following specifications:

2 Cober Transmitters

1 to 10 GHz
350 W continuous wave
1200 W peak pulse power
2 μsec to 1 msec pulse width
25% duty factor

MCL Transmitter

40 to 1000 MHz
1000 W continuous wave or peak pulse power
10 μsec to continuous wave pulse width

AN/FRT-6B Transmitter

4 to 26 MHz
40 kW continuous wave or peak pulse power
10 μsec to continuous wave pulse width

Exposure Cells

Standard and specialized antenna systems are available for use in the available exposure cells.

Anechoic Chamber

10 x 10 x 20 ft
Temperature controlled
Reflectivity better than 40 dB (1 to 10 GHz)

Anechoic Chamber

10 x 10 x 23 ft (tapered)
Temperature controlled
Reflectivity better than 40 dB (0.5 to 10 GHz)

TEM Mode Chamber

3-50 MHz
Exposure volume: Length, 20 ft; width, 5 ft; height, 2.3 ft (one volume of this size above and one below center conductor)
Closed system with matched water-cooled resistive load termination
Power capability: 50 kW

Near-Field Simulator

2 to 30 MHz
500 W continuous wave
40 A/m H-field
20,000 V/m E-field

Specialized Instrumentation

Standard RFR field monitoring and general electronic instrumentation as well as the following specialized instrumentation are available to RFR researchers.

RFR Temperature Probe (Vitek)

No measurable RFR interference
0.01°C accuracy
1 mm diameter probe
Digital and analog readout

Differential Power Measurement System (NBS)

Input power measurement
Output power measurement
Reflected power measurement
Absorbed power measurement
Calibrated by NBS: ± 5%

E- and H-Field Probes

100 to 20,000 V/m E-field
1 to 100 A/m H-field
Calibrated by NBS: ± 5%

Calorimeter Systems

± 0.01°C sensitivity
Mouse or rat whole body

Computer Systems

A portable terminal for the School's PDP 11/70 can be used at 6 locations in the RFR Laboratory. In addition, the following computer systems are available.

PDP-11/34

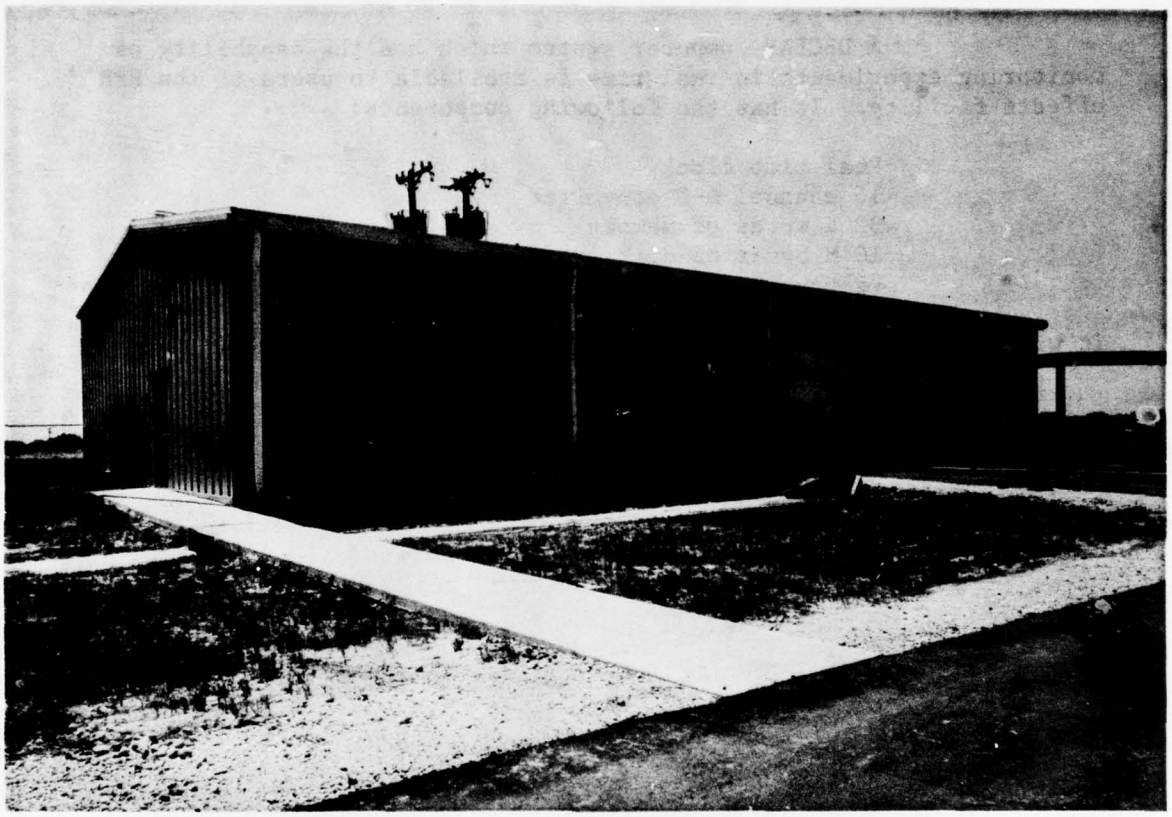
A DECLAB computer system which has the capability of monitoring experiments in real time is available to users of the RFR effects facility. It has the following components:

Real time clock
16 channel A-D converter
32 K words of memory
10 M bytes of disk storage
Vector graphics display with light pen

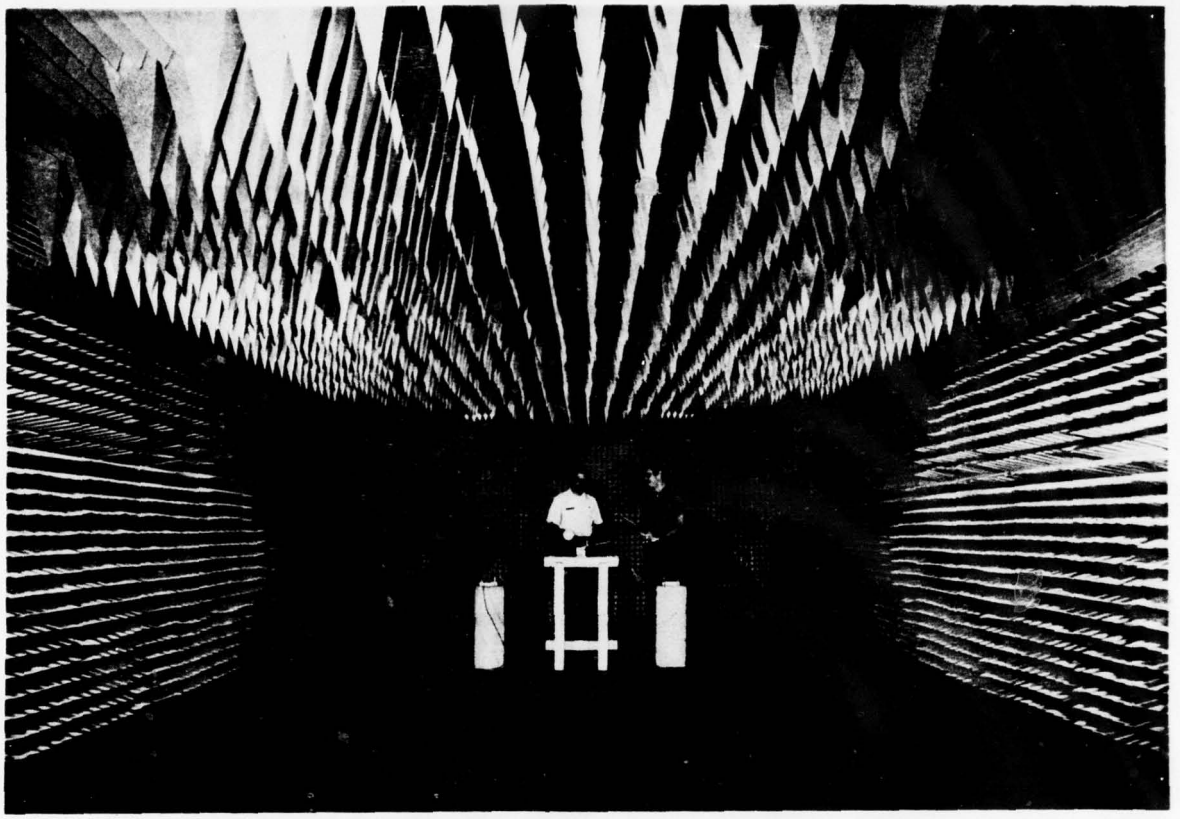
It will also network to the base host computer (PDP-11/70).

HP 9830A Computer System

10 channel scanner
A to D converter
8 K memory



Radiofrequency Radiation Laboratory



Anechoic Chamber

IN-AIR GAMMA AND LOW-DOSE RADIATION FACILITY

General Information

The In-Air Gamma Radiation facility can include nominal 100 and 500 curie cobalt-60 panoramic beam radiators in a large (15 x 15 m) climate-controlled exposure volume. This facility is augmented by a low dose rate (3 x 3 x 3 m) uniform exposure volume using four 15 curie ^{60}Co sources. These sources are suitable for both biologic irradiations and dosimetry calibration. They are particularly useful for studying effects of low-level (i.e., <1 R/hr) fields. All of the sources can be operated from a shielded control room.

Technical Information

Four cobalt-60 source-irradiator units
Source transfer shipping cases
Source remote control panel
Source and control buildings

PERFORMANCE DECREMENT EVALUATOR FOR NONHUMAN PRIMATE STUDIES

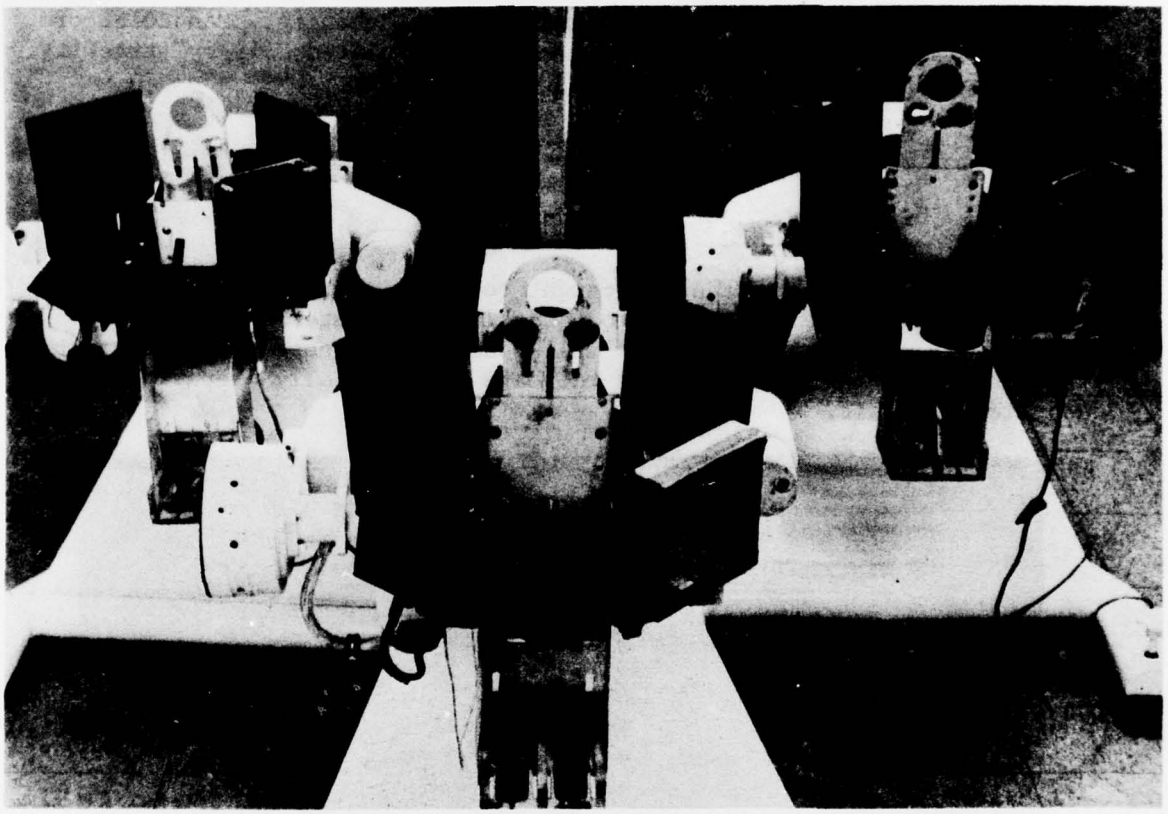
General Information

Aircrew performance data are required for the assessment of a variety of nuclear weapon threats to personnel. Because the hazards are seriously debilitating or lethal in some instances, nonhuman primates and other animals are used as experimental subjects. The national guidelines and standards for medical research have been adopted for all experimentation, and each study is under the auspices of a clinical veterinarian. Data are extrapolated to human performance functions using standard statistical procedures. Human vulnerability (mission success probability) functions have been calculated for several nuclear weapons "near miss" scenarios; chemical defense (antidote) toxicity assessments; and laser-induced vision-decrement evaluations.

Technical Information

Primate Equilibrium Tracking Task

This nonhuman primate flight simulator incorporates a platform which is gimbal mounted in the pitch and roll axes, and the primates are trained to manipulate a control stick to maintain an equilibrium position for the platform. Computerized inputs perturb pitch and roll independently (90° total variation in each axis), and the data are recorded on magnetic tape. Additionally, the reaction time for each subject is obtained using an instrument panel simulating a master caution light and four fire extinguisher switches. This unit requires the primate to touch the master caution switch to turn off the buzzer/light cues, look at the panel to determine which of the four engine fire warning lights is illuminated, and operate the corresponding fire extinguisher switch. Thus, accuracy and response time measures are obtained in addition to the control task data.



Primate Equilibrium Platforms

PRIMATE VISION TRACKING TASKS

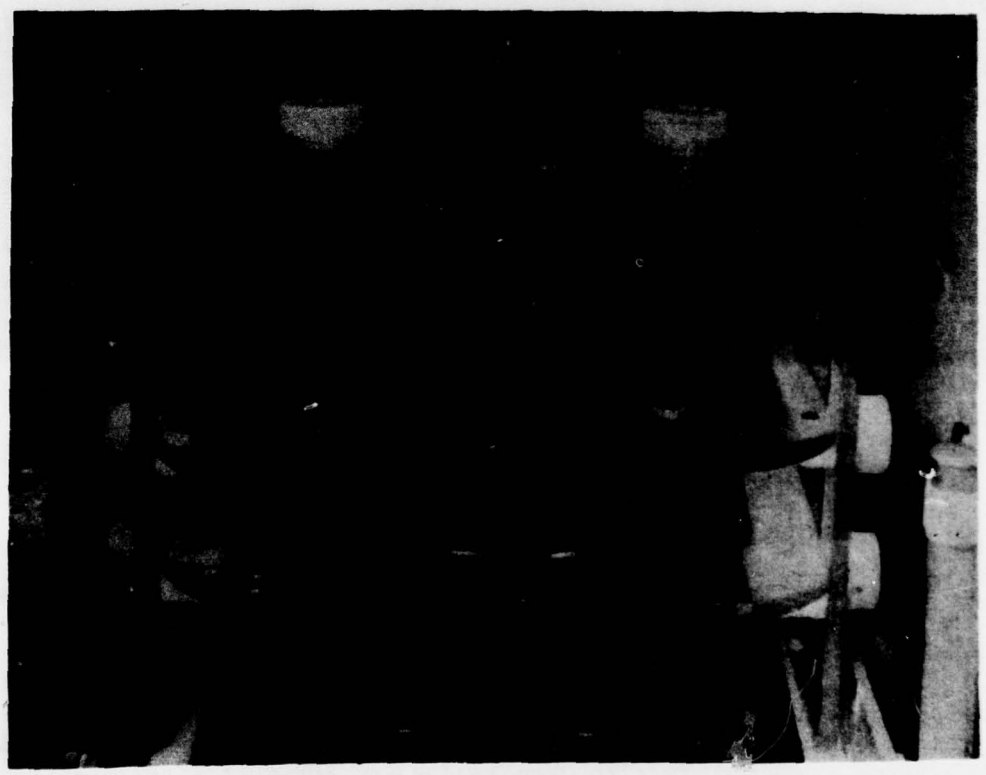
General Information

This capability allows experimental investigations of functional vision and performance efficiency following eye damage, visual perturbations due to drugs, or central nervous system changes. Monocular or binocular acuity can be obtained as well as simulated "fly-by" tracking effectiveness.

Technical Information

Visual Tracking Task

Nonhuman primates are taught to track a moving target by manipulating a "control stick" to maintain the pointer within allowable limits of the target. This dual-beam oscilloscope displayed task is magnetic tape programmed, and the data automatically prepared for computer analysis.



Visual Tracking Task Apparatus

Binocular Test System

Facility includes one unit to test the binocular vision in one subject. Visual acuity (20/10 to 20/400) can be obtained at near (3 ft) or far (20 ft).

Monocular Test System

Facility includes two units to test monocular or binocular (OD, OS, OU) vision at near or far (20/10 to 20/400).

Immediate Effects Test System

Facility includes one unit to test monocular or binocular vision and to detect immediate changes in functional vision. (Laser exposure evaluation can be accomplished while monkey is "reading" the eye chart to determine changes in 10-second blocks of trials.)

Flashblindness Evaluator for Nonhuman Primates

Facility includes one unit to test flashblindness recovery times to light flashes too intense for human experimentation.

Hue Discrimination System

Facility includes one machine to test color perception in infrahuman primates. Preliminary phase only allows testing for "red," "blue," "green," and "white."

Dynamic Acuity System

Facility includes one machine for measuring tracking ability in nonhuman primates in which the "target" is specified in minutes of arc (varying between 0.5 and 10.0 minutes of arc).

BIOMEDICAL LASER EFFECTS FACILITY

General Information

The facility consists of a Laser Laboratory as well as a 1.64 km outdoor laser test range. The laboratory maintains the technical capability and knowledge, including investigations of the loss and recovery of visual function resulting from various laser exposure conditions, required to provide data to the Surgeon General for establishing maximum permissible exposure levels for experimental and operational lasers and laser systems. The lab is also used to develop and test eye-protection materials and devices for the protection of Air Force personnel against hazardous laser radiation.

Technical Information

Biolaser Effects

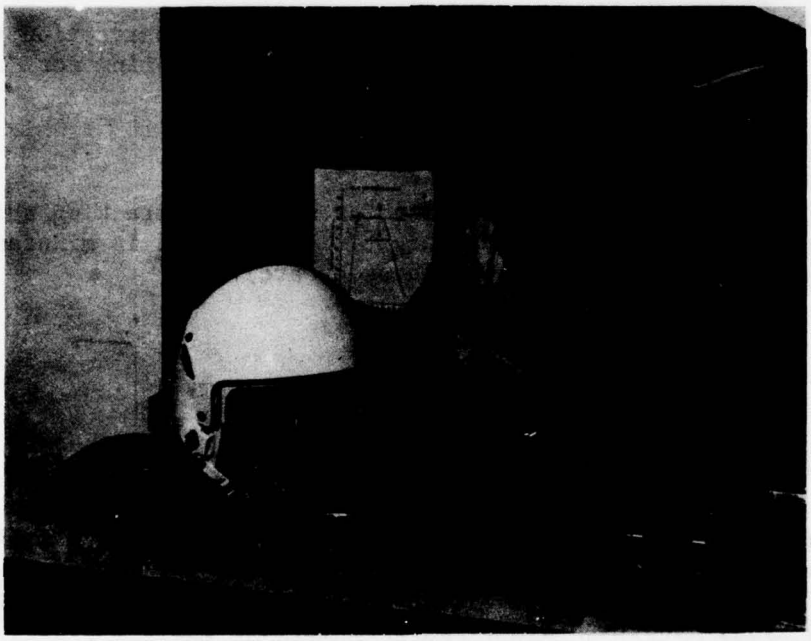
Facility includes various units to determine the corneal, lens, and retinal damage thresholds produced by different laser wavelengths.

Laser Protection

Facility includes computer models that provide timely and accurate laser hazard evaluations to DOD organizations.

Visual Impairment

Facility includes one unit to systematically evaluate visual decrement, visual function recovery, and visual function stresses following exposure to coherent or incoherent light sources.



Laser Hazard Evaluation for USAF Laser-Protection Eyewear

WHOLE BODY COUNTER

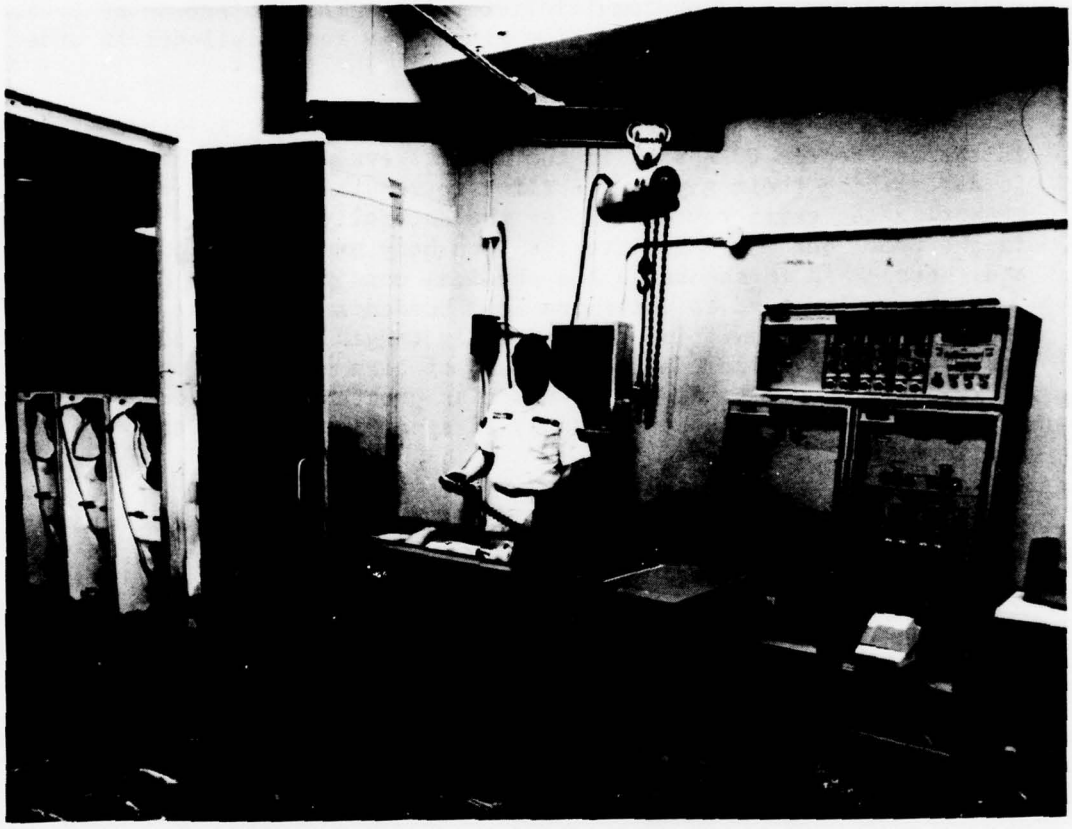
General Information

The Whole Body Counter is located in a specially built low background area. The detector assembly is positioned inside a cell consisting of 4-inch steel walls lined with ½-in. lead. The detector assembly consists of a liquid scintillator contained between two concentric cylinders and sixteen photomultiplier tubes. The subject to be counted is placed in a horizontal position within the inner cylinder in order to simulate a 4π counting geometry.

The Whole Body Counter is used in support of the Aeromedical Consultation Program to assist in the medical evaluation of personnel in determining their physical ability to return to flying status. By measuring the gamma ray emitted by the naturally occurring potassium-40 in the body, one may calculate the lean body mass of an individual and thereby aid in assessing his physical condition. The Whole Body Counter is also used to determine body burden and turnover rates for most of the gamma-emitting radioactively tagged chemical compounds. Past studies have included measurement of lean body mass changes in individuals on strict diets and exercise programs, turnover rates of thyroid compounds, and body burdens of specific gamma-emitting radioactive material.

Technical Information

Packard Model 3375W spectrometer
Packard Model 3002W spectrometer
Sling control
High voltage control
Liquid scintillator
Sixteen 16-in. photomultiplier tubes



Whole Body Counter

CHRONIC RADIATION VIVARIUM

General Information

This facility was built in 1965 by NASA and the U.S. Air Force to provide individual outdoor caging for subhuman primates undergoing experiments to delineate delayed effects from whole body exposure to ionizing, particulate radiation, i.e., cataracts, carcinogenesis, life-span shortening, and/or any other clinical radiation-induced abnormalities. The data base resulting from these experiments is being used to develop safe exposure criteria for radiation encountered during polar and equatorial space missions. It is also used as a long-term indicator of low-level delayed effects. Incorporated within the facility is an enclosed area for examination and treatment, if required, of the animal subjects. During winter months, partial protection from cold temperatures is provided with exterior closure flaps and thermostatically controlled gas heaters spaced equally along the length of each run.

Technical Information

Capacity: 301 monkeys
Cage dimensions: 74 in. (height) x 57 in. (length) x 42 in. (width)
Environmental temperature range:
Summer: Ambient
Winter: Ambient (high) to mid-50°F (low)

Chronic Radiation Vivarium

TECHNICAL SERVICES DIVISION

The Technical Services Division provides broad specialized services in support of the Medical Research and Development, Medical Evaluation and Consultation, Medical Education, and Aeromedical Support missions of the School. The Division functions as the focal point regarding USAFSAM resources (i.e., manpower, materiel facilities, and cost accounting), and provides a variety of support services including biomedical engineering and electronics, audiovisual, fabrication, and aeromedical library.

This Division has proved to be an invaluable cost-saving operation for the School for two primary reasons. First, because of the specialized nature of the medical and scientific mission, many of the required services and equipment items either are not available from commercial sources at any price or would have to be custom manufactured and purchased at prohibitive costs. Second, the Division's in-house capability allows the provision of necessary support services in a minimum of time with direct scientist interface, thus avoiding costly delays in the pursuit of research projects.

ENGINEERING AND MAINTENANCE SERVICES

This facility provides a variety of services to include biomedical electronic engineering in support of the R&D effort, preventive and unscheduled equipment maintenance, calibration/certification of precision measurement equipment, and materiel support.

Biomedical Engineering

General Information

This unit provides biomedical engineering and electronics support throughout the School of Aerospace Medicine and to other Air Force organizations and Federal agencies. Engineers and technicians accomplish the invention, design, development, modification, fabrication, test and evaluation of unique biomedical instrumentation, equipment, and systems to acquire, measure, control, and analyze physical, physiologic, and environmental parameters for aerospace medical research experiments, diagnostic evaluations, and patient care. They also provide specialized professional engineering consultation to research personnel and act as technical advisors to contract monitors who are responsible for contracts involved with biomedical instrumentation.

Technical Information

Printed circuit laboratory with capability to design and develop printed circuit boards where size is not overly critical. Includes facilities for applying photoresist with line resolution of $\leq$ 0.3 in.

Electronic Medical Device Testing Facility consisting of a Dempsey Model 431 Safety Analyzer. Tests instruments for potential shock hazard in conformance with the requirements of AFR 160-3.

Electromagnetic Compatibility Testing Facility consisting of a calibrated spectrum analyzing receiver system for visual display, an automated X-Y plotter recorder for hardcopy records, and a shielded enclosure. The system conforms to the requirements of MIL-STD-461A and MIL-STD-462 tests.

Frequency range: 20 Hz to 1000 MHz
Overall frequency accuracy (on X-Y plot): $\pm$ 3%
Overall voltage accuracy (on X-Y plot): $\pm$ 2 dB
IF, image and spurious rejection: Exceeds 60 dB and in no case less than 45 dB throughout the frequency range 20 Hz to 1000 MHz
Input Impedance: 50 Ohms
Detector functions available: Carrier, peak, quasi-peak, and slideback
Plotting on both 8½ x 11 in. and 11 x 17 in. paper
Semi-automatic X-Y calibration
Octave range spectrum display
Panadopter signature display
Signal locator display
Variable scan rate of 10 sec/band to 15 min/band

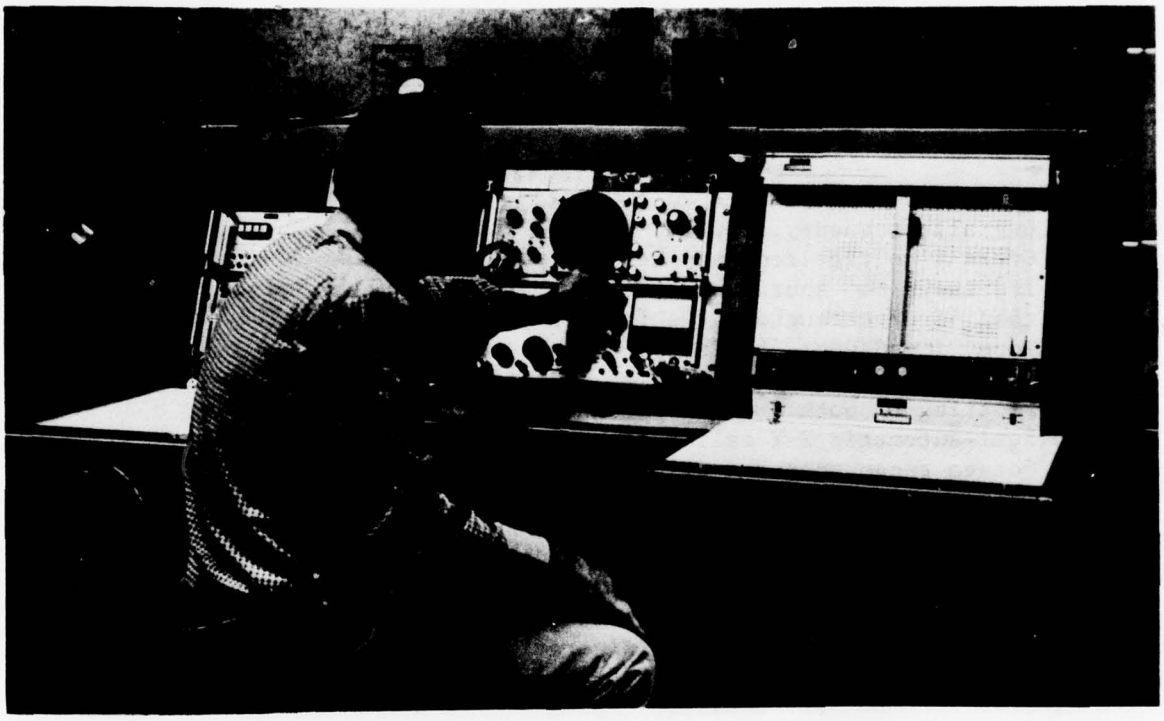
Temperature, humidity, and altitude environmental chamber consisting of a Webber Company Chamber, refrigeration unit, and control console. Temperature range: -100° to 350°F. Altitude: 100,000 ft. Relative humidity: 20% to 95%. Chamber capacity: 64 ft^3 (4 x 4 x 4 ft). The chamber conforms to the requirements of MIL-STD-810C tests.

Sinusoidal and random vibration testing device consisting of an Unholtz-Dickie Model 102 Shaker, horizontal slip-table, and control console. The system conforms to the requirements of MIL-STD-810C tests.

Frequency range: 5 Hz to 5000 Hz
Generated force: 400 lb peak
Armature assembly effective weight: 5.3 lb
Maximum free table acceleration: 75 G
Shaker stroke: 1 in.
Shaker suspension stiffness: 225 lb/in.
Free table axial resonant frequency: 4300 Hz
Payload: 34.7 lb accelerated to 10 G

Shock testing machine consisting of a LAB Corporation Model SD 16-60-200 shock tester and recording instrumentation.

Maximum carriage fall: 60 in.
Carriage resonance: Over 5000 Hz
Carriage weight: 170 lb
Test load rating: 250 lb
Carriage size: 16 x 16 in.
Mechanical saw tooth programmer and 1/2 sinewave pads



Test and Evaluation of Medical Equipment
for Electromagnetic Interference

Maintenance Management

General Information

This unit provides maintenance and repair services and equipment calibration for all medical and nonmedical equipment in the USAF School of Aerospace Medicine and monitors contracts for that portion of the workload accomplished through commercial sources. The staff is comprised of highly trained biomedical technicians and engineers specializing in a wide variety of maintenance and repair fields who monitor thousands of items of equipment. The capabilities are so complete that less than 10% of maintenance and repairs must be allocated to depots or to the manufacturer.

The Precision Measurement Equipment Laboratory, officially chartered and annually evaluated by the Air Force Aerospace Guidance and Metrology Center, maintains the necessary standards with traceability to the National Bureau of Standards for the repair, calibration, and certification of precision measuring test equipment. Technicians perform calibrations, in accordance with Air Force 33K series Technical Orders, in a laminar/flow cleanroom which is scientifically sealed so as to remain dust and lint free. An elaborate humidification and temperature control system is incorporated which also maintains a positive pressure within the laboratory to prevent the inflow of outside atmosphere and contaminants when personnel enter or leave. Environmental conditions, calibration procedures, and safety precautions are monitored daily by Quality Control personnel. As an added effort to insure that the professional staff of the School receives a reliable and accurate product, a minimum of 6.25% of each technician's daily output is randomly selected for compliance and verification inspections of specifications in the 33K series Technical Orders.

Technical Information

Precision Measurement Equipment Laboratory with certified standards for electronic, pressure, flow, and dimensional calibration support.

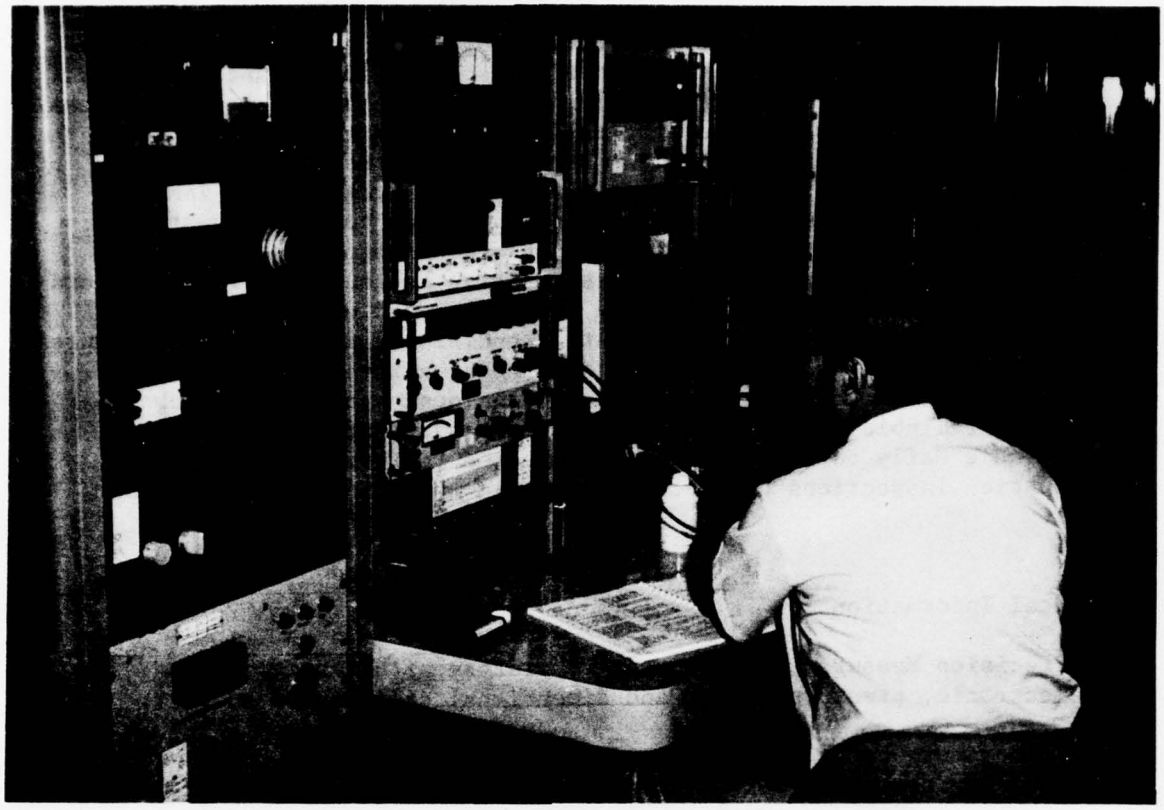
Temperature control: $73^{\circ}F \pm 6^{\circ}$
Humidity control: 30% to 50% RH
Lighting: Minimum 100 ft-candles
Cleanroom standard: Federal Standard 209, Class 100,000
Laminar Air Force rate: 90 ft per min $\pm$ 20 ft per min

Specialized repair areas and bays for in-shop servicing of medical, nonmedical, Air Force, and commercial laboratory equipment.

DeVilbis Water Fall Paint spray booth, 10 ft wide, 6 ft 8 in. high, 6 ft deep.

Gas-fired Paint Drying Oven, 5 ft wide, 5 ft 8 in. high, 6 ft 7 in. deep.

Specialized welding with arc, spot, and heliarc capabilities.



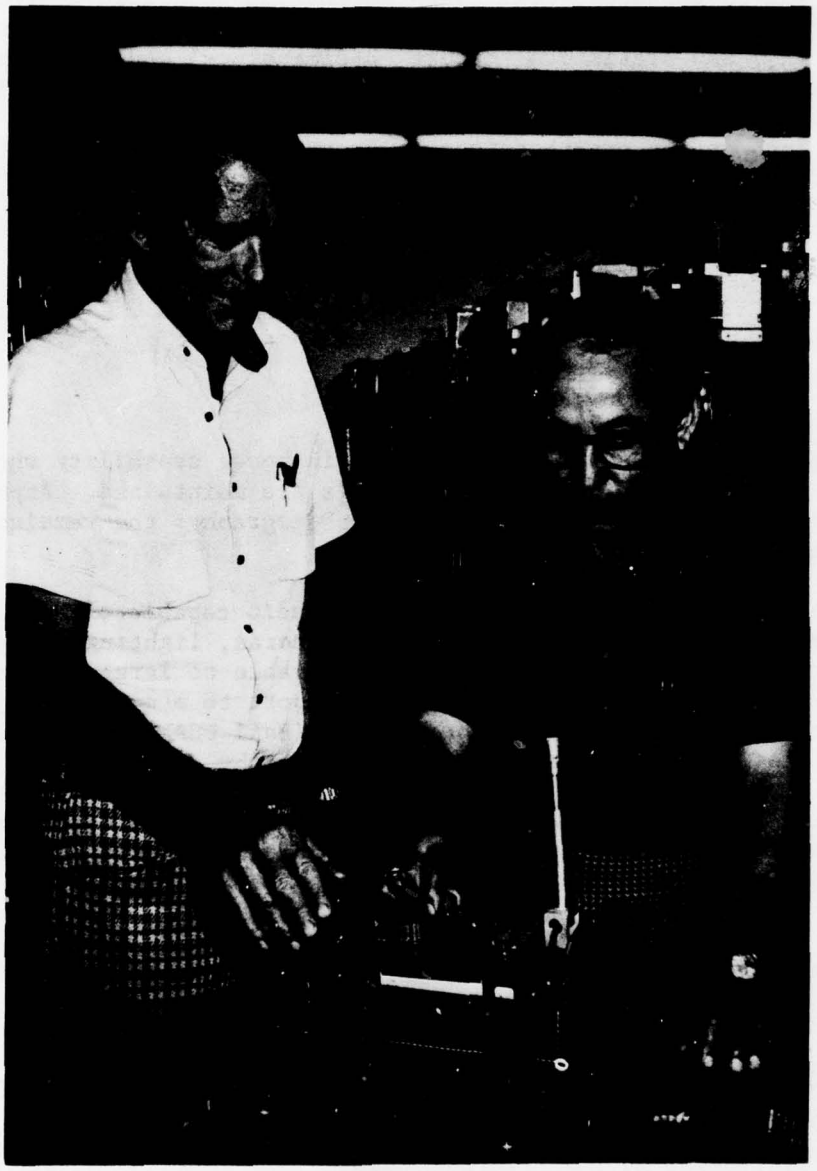
Precision Measurement Equipment Laboratory

Materiel Management

General Information

This unit serves as a supply support focal point between the School personnel and the various sources of supply. Functional responsibilities are receiving, turn-in, or disposal of all supplies and equipment, delivering supplies and equipment, and validating and maintaining intra-Division control of in-use equipment.

The unit maintains a Central Equipment Pool of seldom used equipment for which there is a foreseeable requirement. This inventory of over 816 items valued in excess of $823,000 is made available for short-term loans within the School to reduce equipment redundancy and new equipment acquisition costs. When approved by the Commander, 90-day loans are made to agencies outside the School. Prior approvals by higher headquarters are required for loans to other agencies that are programmed to exceed 90 days.



Central Equipment Pool

AUDIOVISUAL SERVICES

Audiovisual Services facility provides complete black and white and color still photography; television support; specialized medical illustrations and technical equipment illustrations of a medical, technical, engineering, and statistical nature, 3-dimensional models and medical implantation devices; and audiovisual library services, both film and equipment loan, in support of the USAFSAM mission, HQ AMD, and all assigned and tenant organizations on Brooks Air Force Base. If approved, the above-mentioned services will be provided to Wilford Hall USAF Medical Center.

Research Photography

General Information

This service has a self-sufficient in-house capability where rigid quality standards and production controls are maintained. Approximately 85% of the workload represents medical photography; the remainder comprises the normal work of a Base photo lab.

The Photography Section operates a studio capable of handling any photographic situation. The variety of cameras, lighting equipment, and backgrounds provide a capability comparable to large commercial studios. Medical photography includes support to many R&D projects, Epidemiology, Hyperbaric Medicine, Wilford Hall USAF Medical Center, etc. Capabilities include a complete photomicrography department.

Color slide production is a constantly increasing requirement because of the technical and scientific information communicated during medical and educational briefings and symposiums.

Technical Information

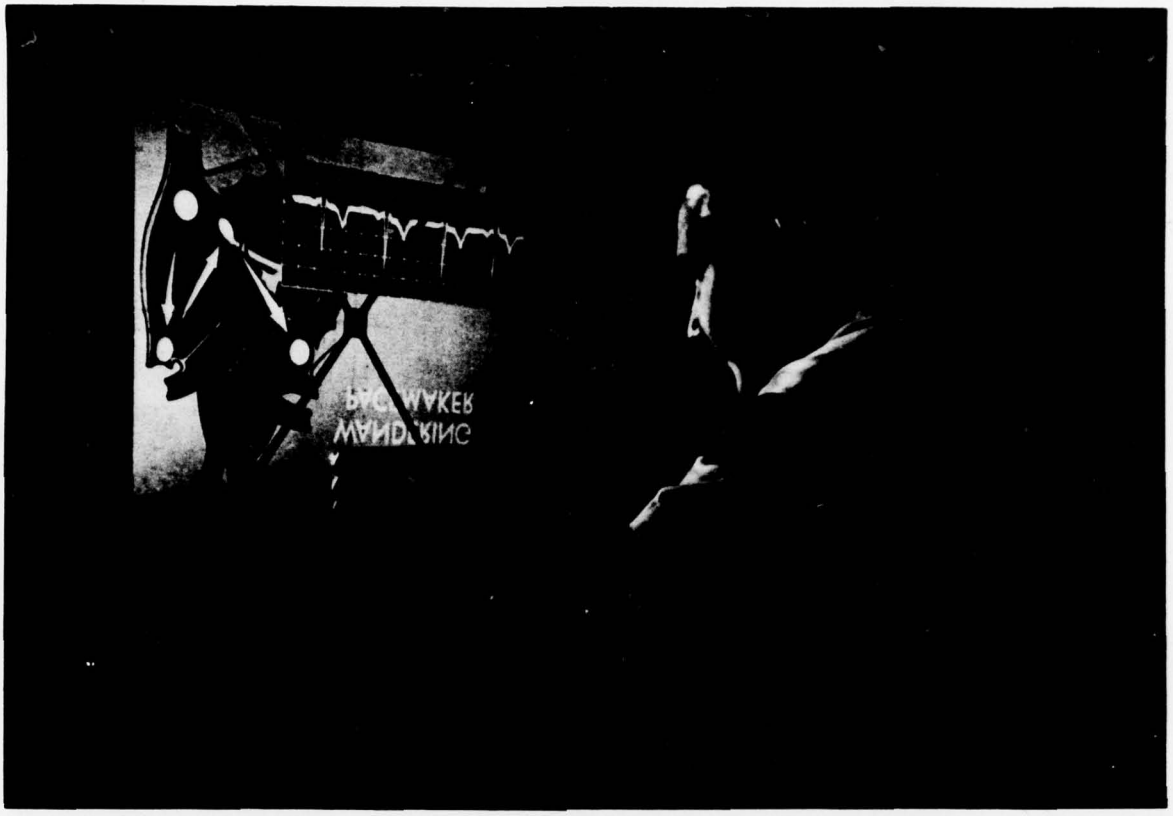
Studio with professional lighting facilities

35mm slide cameras; graphic cameras; portrait and commercial cameras

Complete photomicrography facilities

Slide copy camera for slide production and reproduction

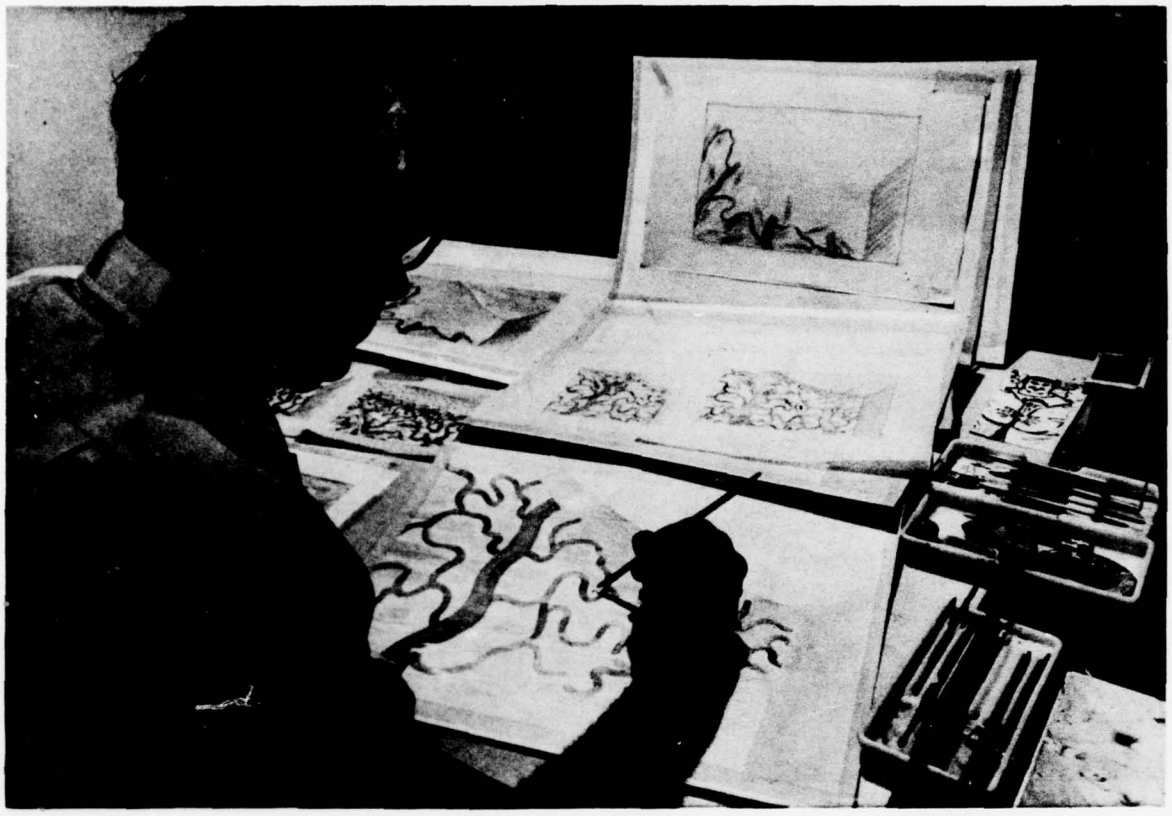
Black and white and color processing and printing facilities



Photographic Copying

Medical Illustrations

The Medical Illustrations Section provides highly specialized illustrating and drafting services of a medical, technical, and statistical nature. Artists in one function produce a variety of illustrations which depict, primarily, anatomy. Another area creates technical equipment illustrations and engineering drawings and blueprints of technical and medical equipment developed by the scientific/medical personnel at the School. In conjunction with these functions is another service which designs and constructs artistic exhibits and displays used extensively in the School's research and educational missions. The capability exists, also, to develop and fabricate intricate miniaturized scale models of medical research equipment, devices, and anatomical organs/microorganisms.



Medical Illustrations

Television

General Information

The closed circuit television services support the USAFSAM R&D mission in addition to the medical programs at Wilford Hall USAF Medical Center with color and monochrome video and video recording support. A two-way microwave capability exists between Brooks AFB and Wilford Hall USAF Medical Center. The TV Function maintains a library of video-taped productions on all subjects relating to aerospace medicine and allied sciences. More than 100 television monitors and receivers are located throughout the Complex for viewing television presentations as well as a dozen cassette playback locations used for study and review. Television support can be provided at any location on Base with portable cameras and video recording equipment.

Technical Information

TV studio with professional lighting, loft, backdrops, and adjacent control room

Portable color and monochrome television cameras

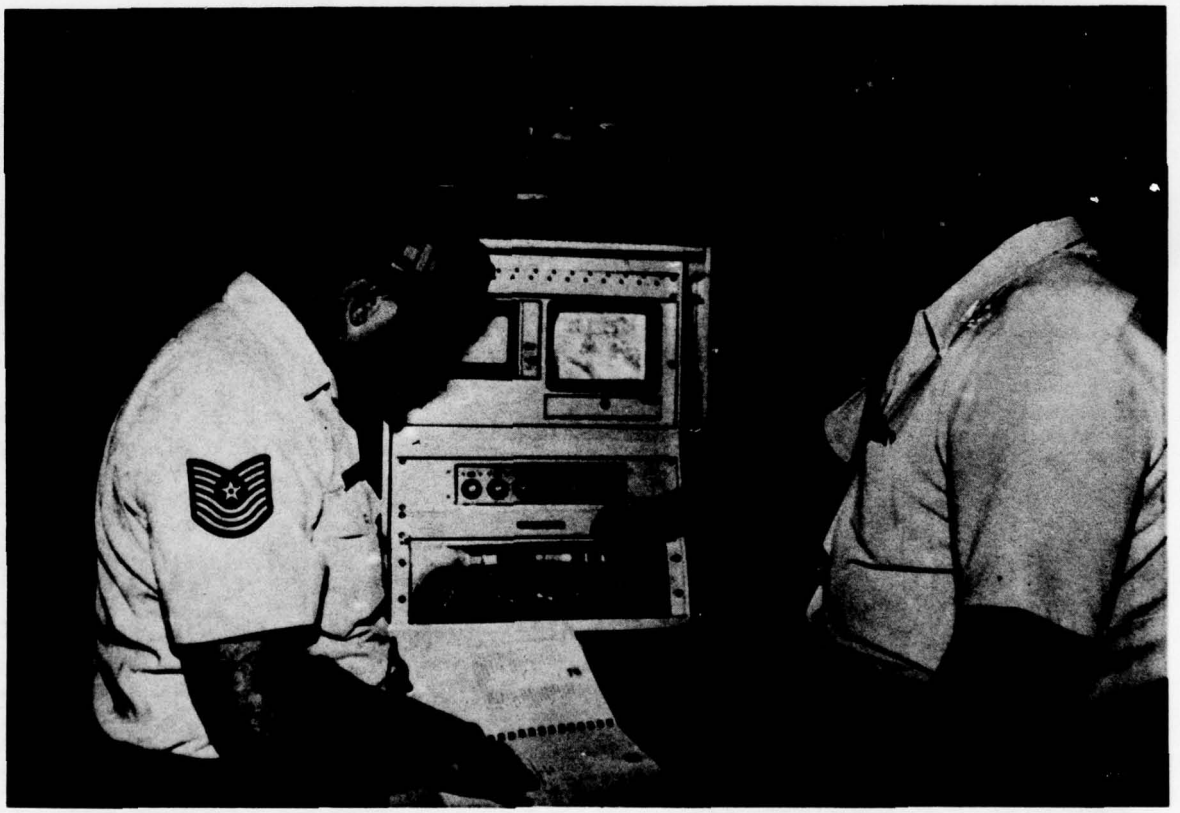
Portable video tape facilities, 1-in. and 3/4-in. cassette for recording color or monochrome pictures

Complete control room facilities for program distribution and recording as well as video tape editing capability

Television film chain and slide projection facilities

Special effects and character generators

Three School channels for program distribution plus four off-the-air channels



Television Camera Monitor

Audiovisual Library

General Information

The Audiovisual Library provides central requisition, distribution, accountability, and control of motion picture prints, audio and video recordings, and other audiovisual media. The library also stores, maintains, issues, and operates audiovisual projection and playback equipment, besides providing training programs in the operation of this equipment.

Technical Information

Preview room with controlled lighting for taking notes

8mm, super 8mm, and 16mm projectors; 35mm slide projectors; overhead projectors, and opaque projectors

Reel tape recorders, cassette recorders, record players

Audiovisual Library Customer Service

AEROMEDICAL LIBRARY

General Information

The Strughold Aeromedical Library, named for Dr. Hubertus Strughold, former Chief Scientist for the Aerospace Medical Division and the "Father of Space Medicine," contains more than 118,000 volumes and subscribes to over 1,900 professional journals, indexes, and abstracts relating to clinical sciences and aerospace medicine. In addition, a collection of some 127,000 documents and technical reports is maintained by the Documents Section in either hard copy or microfiche format. As the largest medical library in the Air Force, this facility supports the requirements of physicians and allied medical personnel, and the more than 2,500 students who graduate annually from the School.

Technical Information

For scientific, technical, and medical information services, a trained staff of professional librarians, editors, and library technicians is available to assist users with their requests. These may range from simple factual information to online retrieval of bibliographic citations, with abstracts, on any subject from computer-based systems.

The Scientific and Technical Information Program (STINFO) and the Medical Editing Section coordinate still another service which involves the publication of papers and the national or international distribution and exchange of all technical reports written by professional personnel at the School. These scientific and technical papers are first reviewed for clarity, professional quality, and conformance to Air Force standards prior to publication. The final manuscripts are then reproduced and bound, and copies are sent to authors, selected Government agencies, civilian universities, and qualified individuals in accordance with a distribution code managed by the STINFO Section.

Strughold Aeromedical Library

On-Line Search Services

FABRICATION

General Information

This facility supports the School's research program by designing and making specialized instruments and medical research equipment. The shop also modifies commercially procured equipment to meet specific laboratory requirements.

The prime purpose of this in-house facility is to manufacture the requested instruments and equipment in a minimum of time so as to avoid costly delays in the pursuit of research projects.

Technical Information

Facilities include:

1. A scientific glass-blowing shop.

2. A well-equipped machine shop which includes a numerically controlled milling machine.

3. A welding shop capable of oxyacetylene, electric arc, and heliarc welding. The welding shop also has electric furnaces for heat-treating metals.

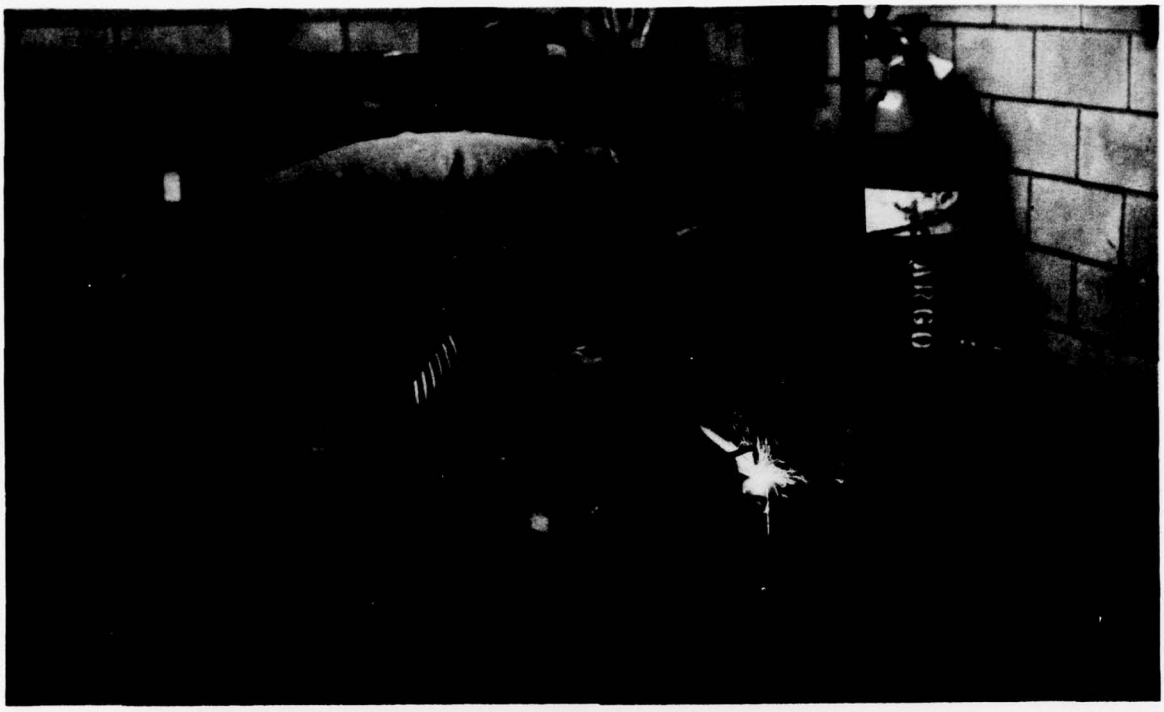
4. A plating shop equipped for plating metals, anodizing aluminum, and electroforming copper.

5. A sheet metal shop equipped to shear, bend, roll form, rivet, and spot weld sheet metal.

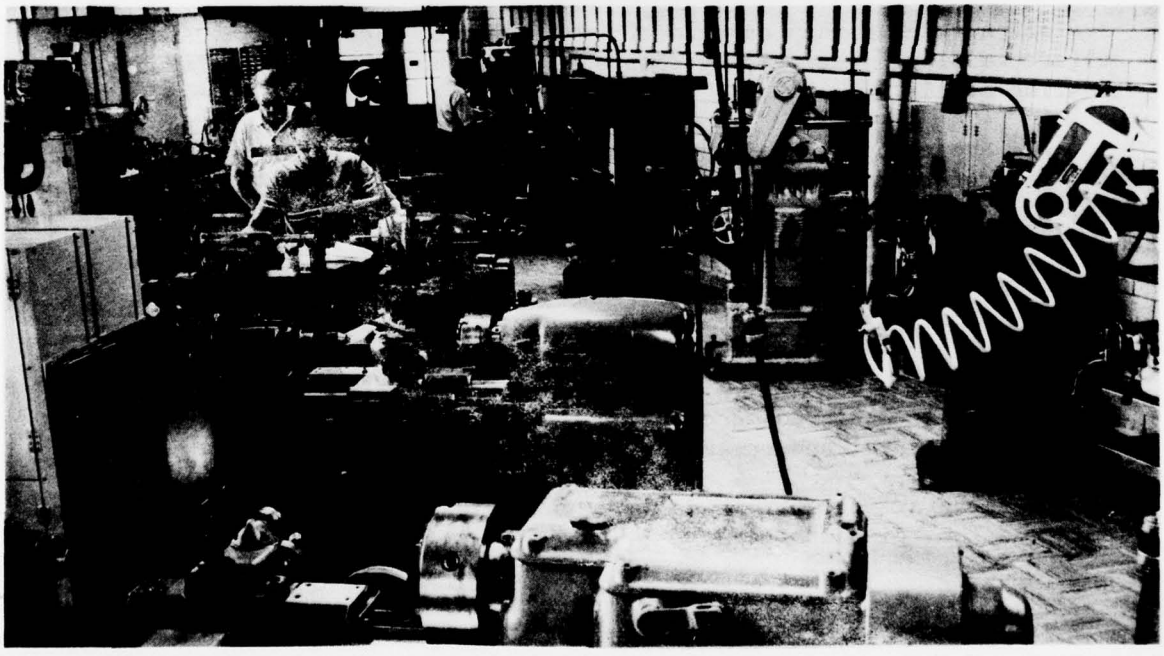
6. Facilities to machine, fabricate, vacuum form, and injection mold plastics.

7. A well-equipped woodworking shop for building models, special cabinets, displays, and cases for equipment.

8. A spray room for painting wood and metal projects and fabricating laminated fiberglass parts.



Oxyacetylene Welding of a Training Aid in Welding Shop



General View of Machine Shop

Glass Blower Forming Column for Gas Chromatograph

Surfacing Board in Woodworking Shop

CHEMICAL STORAGE FACILITY

General Information

This facility houses those chemicals, gases, and hazardous substances excess to immediate needs in the individual laboratories, and chemicals awaiting disposal actions. The facility is designed to reduce daily compromise of personal safety; reduce the threat of destruction to high-cost laboratory facilities and equipment from accidental spills, fire, or explosion; and assure proper safety and control measures in the storage of dangerous materials awaiting disposition.

Technical Information

Special features of the facility include:

Construction of noncombustible material

Lightning protection system

Roof blow-out panels in case of explosion in the facility

Halon fire suppression system

Separate storage compartments for incompatible chemicals, flammables, and toxics with individual storage lockers

Explosion-proof electrical fixtures and refrigerators

Underground storage tanks for the collection of spilled material in the facility

Computerized alarm in the event of fire and extremes in temperature and air flow

Separate covered open air compressed gas-cylinder storage area

Emergency deluge showers and eye wash fountains

VETERINARY SCIENCES DIVISION

The Veterinary Sciences Division is responsible for managing and conducting a comprehensive laboratory animal resources program in support of USAF School of Aerospace Medicine biomedical research programs utilizing animal models. Facilities and professional and technical personnel are available to provide laboratory animal maintenance and care for a variety of species and comparative pathology and surgical support. Direct research support is provided through consultation, professional and technical assistance, and collaboration on studies. Problems and unique requirements related to the use of animal models are investigated.

RESEARCH ANIMAL UNIT

General Information

This unit is capable of providing care and maintenance for a variety of laboratory animals in the various facilities of the centralized colony. A quarantine and holding area for recently acquired animals, several types of short- and long-term housing, and related support facilities are available. Project support capabilities include animal restraint, preparation of special diets, collection of specimens, administration of drugs, and other supportive treatments.

Technical Information

Major facilities include:

Quarantine and holding unit with a capacity of 300 primates, 140 dogs or pigs, 24 rabbits, and 10 cats

Closed primate colonies having 301 and 60 runs

More than 700 individual cages for holding primates

Seventeen gang cages with a total capacity of approximately 135 primates

Limited caging for baboons or chimpanzees

Ninety-nine indoor and 52 outdoor runs for holding dogs or pigs

Twelve rooms for holding rodents or rabbits

An eight-stall unit for large quadrupeds and a six-pen unit for pigs or similar animals

Cage and rack washers for cleaning and sanitizing cages and equipment

Environmental Protection Agency approved incinerator for disposal of animal carcasses

COMPARATIVE PATHOLOGY

General Information

This unit has broad capabilities in both research and diagnostic pathology. These include gross and histologic anatomic pathology, transmission and scanning electron microscopy, and basic clinical pathology. Special histologic procedures, including histochemistry, can be accomplished.

Technical Information

Major equipment items include:

Hitachi HU-12A and RCA EMU-3 transmission electron microscope

ETEC scanning electron microscope

Reichert and Zeiss photomicroscopes

Reichert OmU3 ultramicrotome

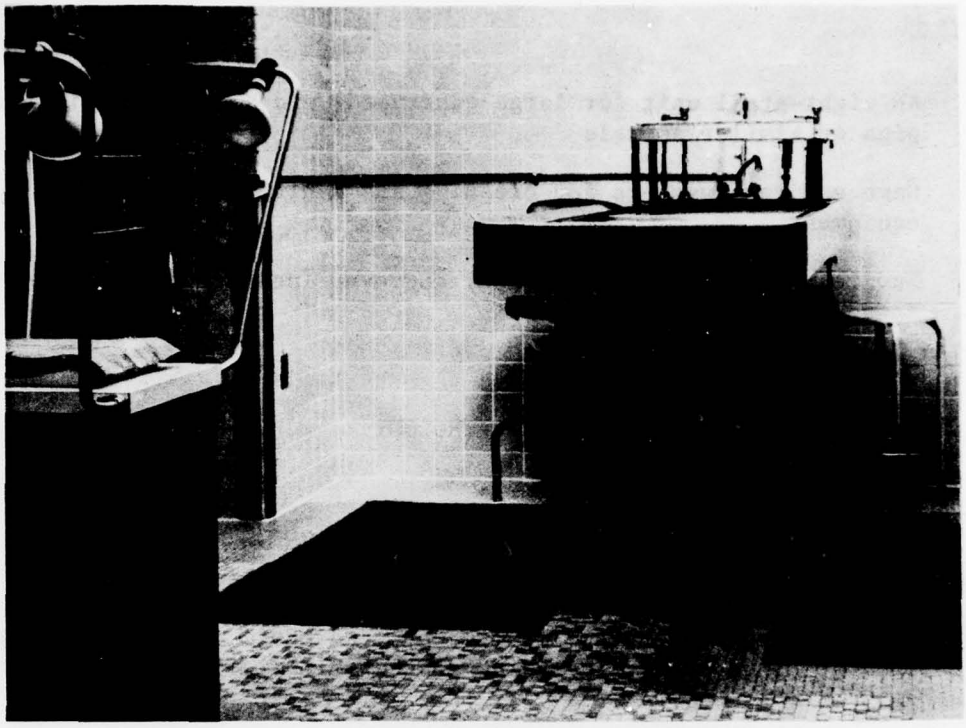
Porter-Blum MT-2 ultramicrotomes

Cryocut microtome

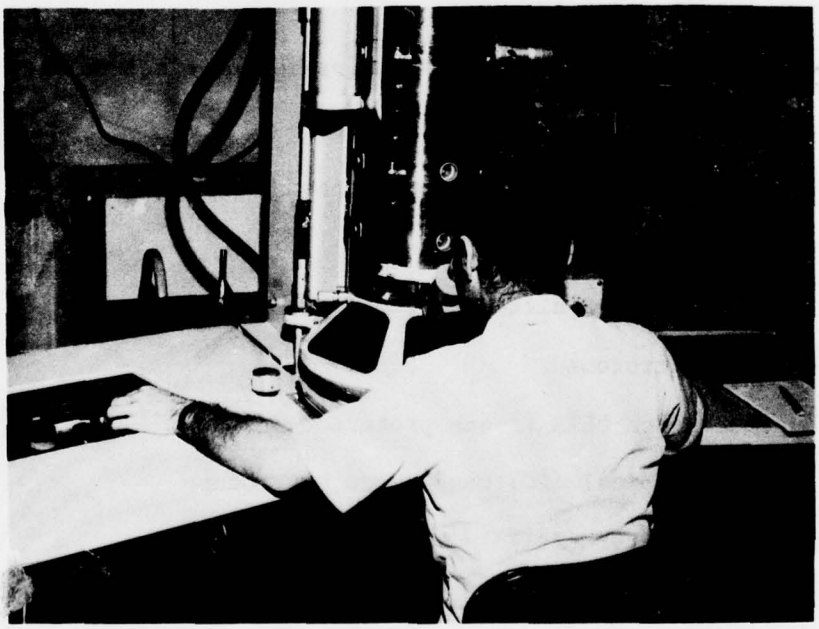
Autotechnicon ULTA tissue processor

American Optical (AO) conference microscope

Coulter counter (ZBI)

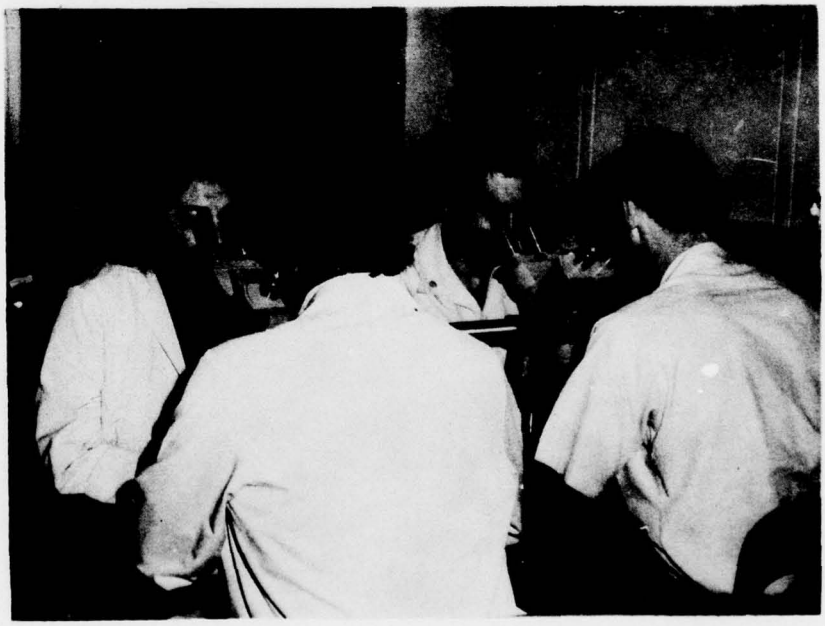


Necropsy Laboratory



Transmission Electron Microscope (TEM)

Scanning Electron Microscope (SEM)



Conference Microscope

SURGICAL SUPPORT

General Information

A fully equipped surgical suite, including a central supply section, is maintained to provide surgical and gas anesthetic support. Three major operating rooms are available and capabilities include thoracic and cardiovascular procedures. One minor surgery room is also available as a researcher workroom for acute physiologic monitoring procedures. Postoperative care facilities include a recovery/intensive care room and cages or runs for housing various species of animals, including pigs and goats.

Technical Information

Major equipment items include:

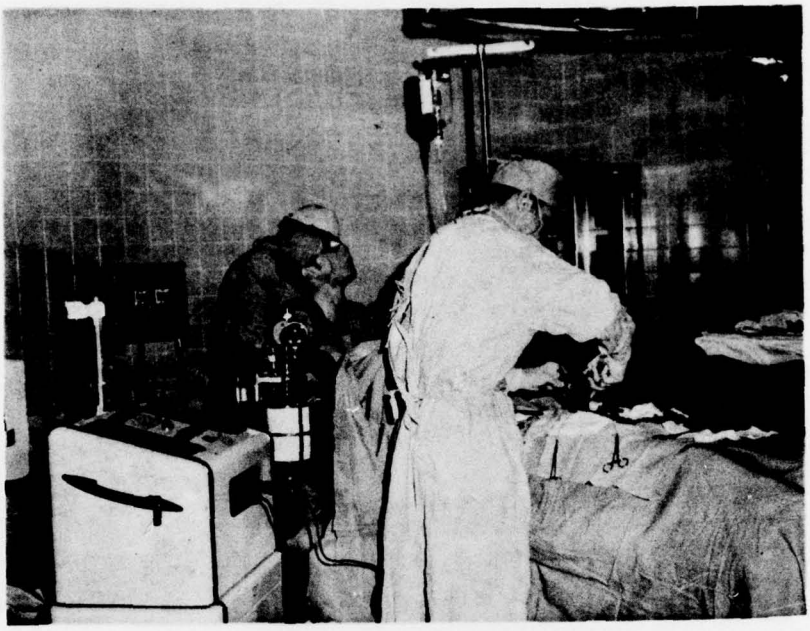
General Electric 350-II 300 MA x-ray unit with fluoroscopy capability and TV monitor

Kodak RP X-OMAT automatic rapid x-ray film processor

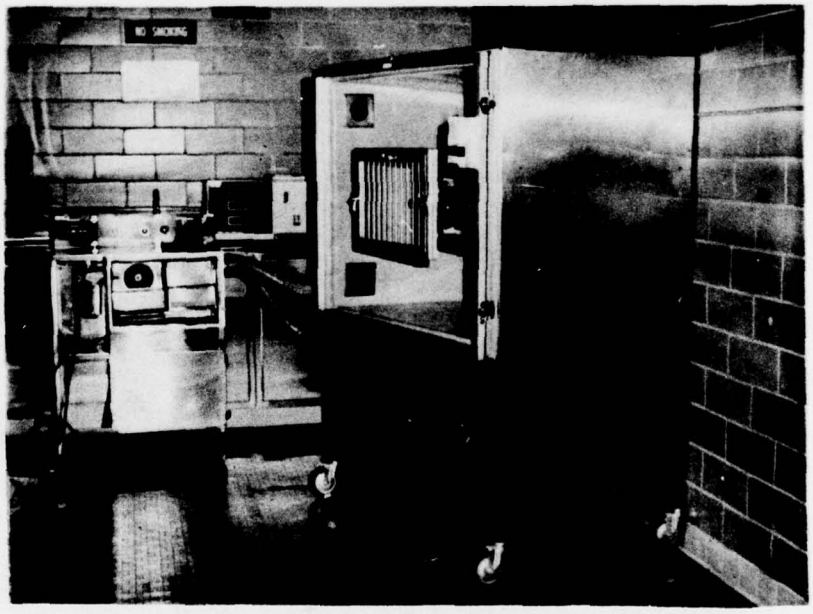
Kirschner intensive care unit

Intrumentation Laboratories (IL) 313 blood gas analyzer

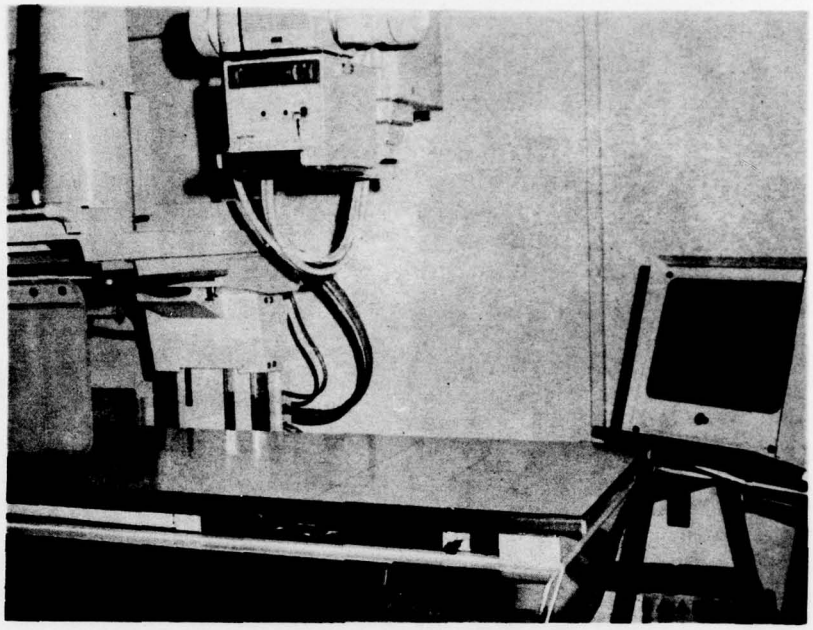
Steam, dry heat, and ethylene oxide gas sterilizers



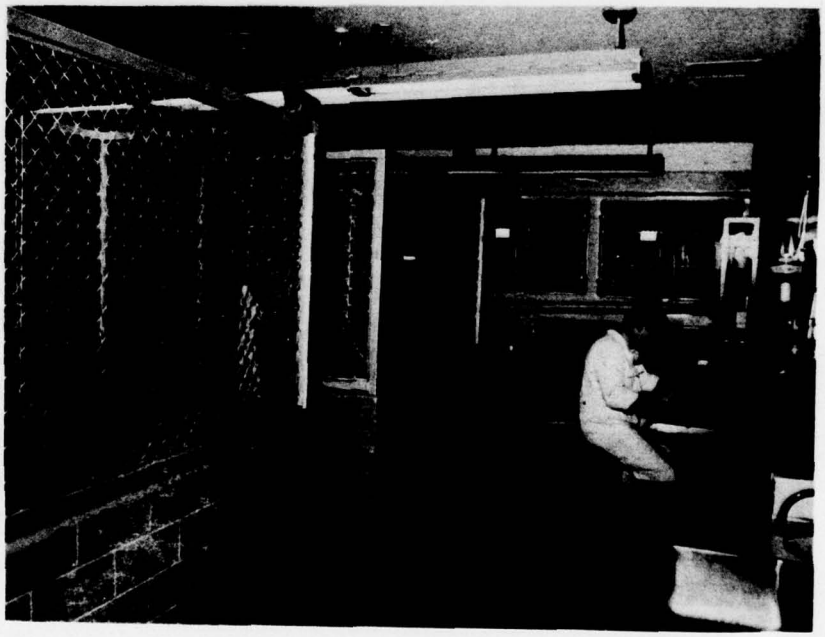
Operating Room



Intensive Care Unit



X-Ray Unit



Postoperative Holding Area

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